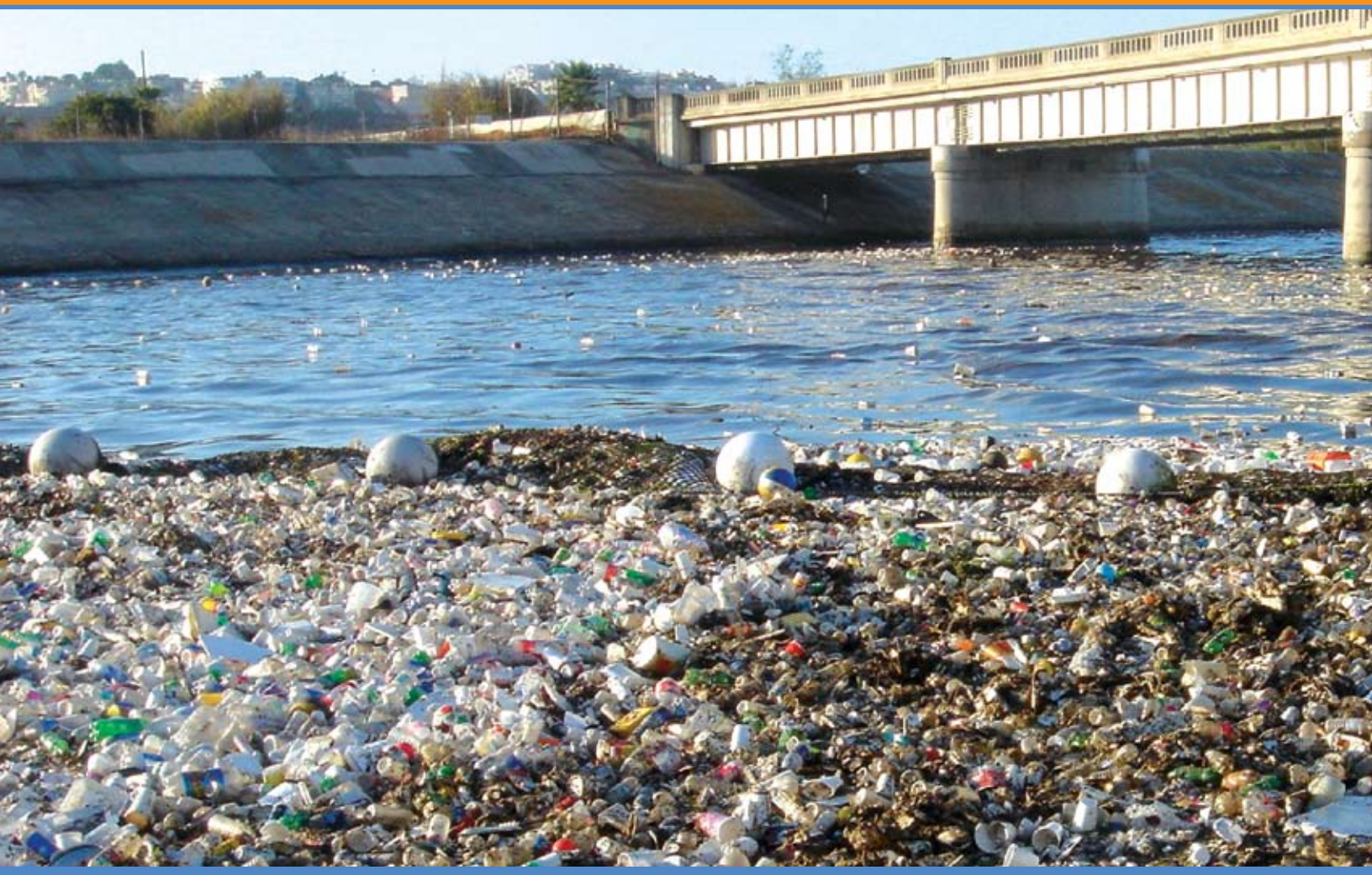
Eliminating Land-based Discharges Of Marine Debris In California:

A Plan of Action from The Plastic Debris Project



ALGALITA MARINE RESEARCH FOUNDATION

CALIFORNIA COASTAL COMMISSION

Eliminating Land-based Discharges of Marine Debris in California:

A Plan of Action from The Plastic Debris Project

June 2006

WRITTEN AND PREPARED BY:

Miriam Gordon, California Coastal Commission

PUBLISHED UNDER THE DIRECTION OF:

Christiane Parry, California Coastal Commission
Deborah Neiter, Los Angeles Regional Water Quality Control Board

Printed on recycled paper

FUNDING PROVIDED BY:

State Water Resources Control Board

ACKNOWLEDGEMENTS

PRODUCED BY:

Plastic Debris, Rivers to Sea Project
Algalita Marine Research Foundation
California Coastal Commission

FUNDING PROVIDED BY:

State Water Resources Control Board

This publication was developed with the assistance and expertise of a large and diverse group of representatives of public and private organizations that have a role in the marine debris issue in California. The *Plastic Debris, Rivers to Sea Project*, implemented by the Algalita Marine Research Foundation (AMRF) and the California Coastal Commission (CCC), produced this Plan with the assistance of the Project Advisory Board and the Marine Debris Work Group.

WORKSHOP DEVELOPMENT AND FACILITATION

Special assistance in the development and facilitation of the two workshops was provided by a small group of advisors and experts. The Project is grateful to the San Francisco Regional Water Quality Control Board for providing our lead facilitator for the workshops. We were fortunate to have the assistance of the following individuals in the development and facilitation of the workshops:

Lead Facilitator:

Christine Boschen, San Francisco Bay Regional Water Quality Control Board

Assistant Facilitators:

Christine Flowers, California Integrated Waste Management Board
Miriam Gordon, California Coastal Commission
Deborah Neiter, Los Angeles Regional Water Quality Control Board
Christiane Parry, California Coastal Commission

PROJECT ADVISORY BOARD

The Project is grateful to its Advisory Board, which has worked for the two-year duration of the project with dedication, open mindedness, and clear commitment to solving the myriad problems associated with marine debris. The Advisory Board assisted the project staff in developing the framework for the Action Plan and provided extensive review and comment throughout the process. Members of the Advisory Board represent a wide array of stakeholders and experts in marine debris, stormwater pollution, solid waste management, the plastics industry, coastal ecosystem research and environmental protection. The Advisory Board members include:

Constance Anderson	State Water Resources Control Board
Richard Anthony	California Resource Recovery Association
Stephanie Barger	Earth Resource Foundation
Robert Bateman	Roplast Indsutries
Richard Boon	Orange County Stormwater
Jill Brandts	Society of the Plastics Industry
Frank Capalupo	Society of the Plastics Industry
Christine Flowers	California Integrated Waste Management Board
Dominic Gregorio	State Water Resources Control Board
James Gubera	XS Polymers

Stephen Groner	S. Groner Associates
Laurie Hansen	California Film Extruders and Converters Association
Ray Hufnagel	Plastic Express
Steven Jones	JATCO Inc.
Robin McCraw	State Water Resources Control Board
Shelley Moore	Southern California Coastal Water Research Project
Mark Murray	Californians Against Waste
Deborah Neiter*	Los Angeles Regional Water Quality Control Board
Ted Schettler	Science and Environmental Health Network
Charlie Scott	Cascadia Consulting (for Amercian Plastics Council)
Seba Sheavly	The Ocean Conservancy
Eric Stein	Southern California Coastal Water Research Project

** Funding agency grant manager*

THE MARINE DEBRIS WORK GROUP

The Project determined that potential implementers of actions listed in the Plan should be involved in the Plan's development. The Plan's "potential implementers," include government agencies, the plastics industry, environmental organizations, and research institutes. Representatives of organizations that were determined by the Project to be "potential implementers" were invited to participate and formed the Work Group on Marine Debris. Work group participants attended workshops and provided review and comment on the Action Plan during its various phases of development. The participants in the Work Group included:

Sarah Abramson	Heal the Bay
Paul Alva	Los Angeles County Department of Public Works
Leah Akins	California Resources Agency
Holly Bamford	National Oceanic and Atmospheric Administration
Nir Barnea	National Oceanic and Atmospheric Administration
Michael Bowen	State Coastal Conservancy
Bart Broome	Staff to Assemblyman Mark Leno
Roxanne Cargill	California Department of Conservation
Gilbert Canizales	California Grocers Association
Andrew Casana	California Restaurant Association
Patty Enneking	American Plastics Council
Denise Douglas	San Joaquin County Public Works
Pete Dinger	American Plastics Council
Zoila Finch	County of Orange Stormwater Program
Pat Franklin	Container Recycling Institute
Joe Geever	Surfrider Foundation
Vincent Gin	Orange County Resources and Development Management
Karen Heyler	Port of San Diego
Jim Hill	California Department of Conservation
Ray Halowski	Surfrider Foundation
Timony Hood	United States Environmental Protection Agency
Kara Kemmler	State Coastal Conservancy
Micheal Leaon	California Integrated Waste Management Board
Shelly Luce	Santa Monica Bay Restoration Commission
Sarah Mosko	Earth Resources Foundation
Charles Moore	Algalita Marine Research Foundation
Alfredo Magallanes	City of Los Angeles
Marlene Mariani	Keep California Beautiful
Ziad Mazbouti	City of San Juan Capistrano

Tom Mays	State Water Resources Control Board
Meredith McCarthy	Heal the Bay
Donna Meyers	National Oceanic and Atmospheric Administration
Sonia Nasser	Dana Point Harbor District
Douglas Nuttal	Crowne Poly
Lindsey Payne	Earth Resources Foundation
Rebecca Pollock	State Coastal Conservancy
Fred Rubin	Los Angeles County Department of Public Works
Mark Sandoval	City of Long Beach
Nicole Saunders	Californians Against Waste
Mark Sandoval	City of Long Beach
Caleb Shaffer	United States Environmental Protection Agency
Mary Kay Shafer	California Department of Conservation
Tom Tanner	California State Parks
Raynor Tsuneyoshi	California Department of Boating and Waterways
Jennifer Voccola	City of Malibu
Sherri White	American Plastics Council
Rick Wilson	Surfrider Foundation

ADDITIONAL REVIEWERS

Participants in the *Plastic Debris, Rivers to Sea Conference* (September 7–9, 2005) were given the opportunity to review and provide input on the proposed Action Plan. The participants in the Conference represent a diverse group, including representatives of local, state and federal government, coastal and environmental protection organizations, plastic industry representatives and facility operators, research scientists, and vendors of storm water control technologies. The authors of this Plan thank the following conference participants for their review and comment on the Action Plan:

Richard Bailey	Lake Merritt Institute
Monica Costa	Federal University of Pernambuco, Recife-Brazil
David Johnson	California Department of Boating and Waterways
Shahram Kharaghani	City of Los Angeles, Department of Public Works
	Alpha Boats
Hal Schillinger	KriStar Enterprises
Walker Reed	Ocean Laguna Foundation
Sam Rifman	Algalita Marine Research Foundation
Lorena Rios	University of the Pacific
Vivian Matuk	California Coastal Commission

AMRF PROJECT STAFF

Staff of the Algalita Marine Research Foundation whose assistance, research, and support were essential to this effort included:

Marieta Francis
Gwendolyn Lattin
Charles Moore
Ann Zellers

Table of Contents

List of Tables

Executive Summary

Marine Debris is a Pervasive Global Issue

Since the 1970s, marine debris has been widely recognized as a threat to the marine environment. Research shows that, despite global treaties to prevent dumping at sea and increasing efforts world-wide to protect water quality, the quantity of debris in the world's oceans is increasing. For example, the abundance of micro-sized plastic debris in the North Pacific tripled during the last decade.[1] During the same period, near the coast of Japan, quantities of plastic debris increased by a factor of 10 every two to three years.[2]

Data collected on debris accumulation in the Southern Ocean shows increased and accelerated quantities appearing on remote shores over the last three decades. The rate of change is most extreme at cold temperature/ polar latitudes, showing that plastics are pushing polewards and threaten to turn the pristine shores of Antarctica into wasteland.[3]

Historically the Ocean Has Been Viewed as a Dumping Ground

The world's oceans comprise 70% of the planet's surface area. Perhaps it is due to this vastness that the ocean has been treated as a waste repository. Like outer space, it is viewed as "away." Society at large is only beginning to appreciate that humans are dependent upon and inextricably connected to life in the oceans. Maintaining the health of marine ecosystems is important to our very survival.

Before the 20th century, materials discarded to the marine environment from shore or at sea were generally non-synthetic and degradable. Since the development of industrial manufacturing in the mid 20th century, consumer products are increasingly made of synthetic materials. The increasing use of plastic in consumer materials has created a type of marine debris that persists in the marine environment for a long time – far longer than the period of time that they have been in existence (100 plus years), which is the time that has been available for scientists to measure degradation. Plastic resin polymers are so strong and so durable that predictions of the time it takes various types of plastics to degrade range from hundreds of years to never.

Plastics Have the Most Significant Impact

The majority of marine debris is comprised of plastic materials – 60–80% overall and 90% of floating debris is plastic.[4] Therefore, assessing solutions to the problem of marine debris focuses attention on the manufacture, usage, and disposal of plastic materials.

Plastics production and use has grown because of the many advantages plastics offer over other more traditional materials. A few of the desirable intrinsic properties of plastics include: (1) design flexibility – plastics can be modified for a wide variety of end uses; (2) high resistance to corrosion; (3) low weight; (4) shatter resistance; (5) water resistance; and (6) air impermeability. As food wrap and containers, plastics preserve freshness and protect against contamination. They are inexpensive and often disposable and thereby more convenient for consumers.

---

[1] Charles Moore, Gwen Lattin, Ann Zellers, "Density of Plastic Particles found in zooplankton trawls from Coastal Waters of California to the North Pacific Central Gyre," in *Proceedings of the Plastic Debris, Rivers to Sea Conference*, 2005. www.plasticdebris.org.

[2] Ogi, Haruo and Fukumoto, Yuri, "A Sorting Method for Small Plastic Debris Floating on the Sea Surface and Stranded on Sandy Beaches," *Bulletin of the Faculty of Fisheries*, Hokkaido University 51(2), 2000, 71-93

[3] Barnes, David, K., "Remote islands reveal rapid rise of southern ocean debris," *The Scientific World Journal*, 5, 915-921. DOI.O.1100/ISW.2005.120.

[4] J.G.B. Derraik, "The pollution of the marine environment by plastic debris: a review" *Marine Pollution Bulletin* 44 (2002): 843; Gregory, M.R., Ryan, P.G. "Pelagic plastics and other seaborne persistent synthetic debris: a review of Southern Hemisphere perspectives" in Coe, J.M. Rogers, D.B. (Eds.), *Marine Debris–Sources, Impacts and Solutions*, (1997) Springer-Verlag, New York, pp. 49-66.

However, it is these same qualities that cause plastic debris to be hazardous to marine wildlife. When exposed to the elements, plastics photo-degrade (i.e., break up into smaller pieces when exposed to sunlight). These smaller pieces persist in the marine environment and continue to degrade but if the polymers remain intact they may never disappear. Plastic pieces are often buoyant, circulating on ocean currents over great distances. Researchers have found alarming quantities of plastic debris in the open ocean and on remote beaches. Many species of wildlife are known to ingest plastic, mistaking it for food. They can also become entangled in it. Even zooplankton and marine invertebrates are known to ingest small plastic fragments of marine debris.[5]

The Rationale for a Land-Based Approach

This Action Plan focuses on land-based discharges because they are the most significant part of the marine debris problem and because they have not been the specific focus of historical efforts to control marine debris. Consumer products, particularly plastic materials, end up in the marine environment and can become widely dispersed.[6] Most of these products are conveyed through runoff from urban areas to the marine environment and make their way to the far reaches of the planet. Estimates indicate that 80% of marine debris comes from land-based sources.[7] Although some programs are being successfully implemented to remove drift nets and other large items of marine debris, the vast majority of debris cannot be removed due to its small size and abundance.

There is no viable way to remove this pervasive debris problem from the world's oceans. This leaves only one option for protecting the already beleaguered marine environment from persistent, mostly plastic, marine debris. We must stop the flow of litter and other human-generated debris to the marine environment. By focusing efforts on urban areas, we focus on the most significant sources and conveyances of debris.

The Plastic Debris, Rivers to Sea Project

The Algalita Marine Research Foundation (AMRF) and the California Coastal Commission (CCC) developed a joint program aimed at focusing attention on the significance of land-based discharges of marine debris – the *Plastic Debris, Rivers to Sea Project*. The Project, which was implemented in 2003-2006, received significant funding and support from the State Water Resources Control Board (SWRCB) through a Proposition 13 grant.

With a history of investigating the character and extent of the plastic debris problem in the Pacific Ocean and coastal waters of Southern

[5] Richard C. Thompson, "Lost at Sea: Where is all the Plastic?" *SCIENCE Magazine*, 838, (May 7, 2004): 304.

[6] J.G.B. Derraik at 842-852.

[7] U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Public and Constituent Affairs, "Turning to the Sea: America's Ocean Future" (1999): 56. See also, UNEP, United Nations Environment Programme (1995) "Global Programme of Action for the Protection of the Marine Environment from Land-based Activities." Note by the secretariat. UNEP (OCA) /LBA/IG.2/7

California, AMRF conducted further research during this two-year Project. Their investigation showed clearly that litter and industrial discharges of pre-production plastic pellets and powders originate from inland urban areas and migrate through storm drain systems to beaches and coastal waterways.

The CCC helped to focus local and international attention on marine debris as a land-based issue by developing an international conference on plastic debris, a film about the problem, a website (www.plasticdebris.org), a manual of trash BMPs for local storm water programs, and by facilitating the development of this Action Plan.

A Diverse and Multi-Faceted Response is Necessary

Marine debris is a complex problem caused by a multitude of activities and failures. This Plan reflects the belief that marine debris from land-based discharges requires a multi-faceted response and the involvement of all stakeholders. Therefore, this is a Plan for all potential implementers including government, industry, the environmental community, and academia.

The Plan reflects multiple approaches and opinions about the solutions to marine debris. It is not streamlined to recommend only actions for which a consensus of opinion was reached. The Plan was not developed as a hierarchy of priority actions, although some immediate priorities were developed, as discussed below. Essentially, it is a broad ranging Action Plan published with the goal that all "potential implementers" mentioned in the Plan will act and a multiplicity of actions will result, thereby benefiting the marine environment to the greatest extent possible.

Past efforts to reduce marine debris in the United States focused largely on the passage and implementation of an international treaty to prevent the discharge of plastics at sea, volunteer beach cleanups and monitoring, a focus on the waste management practices of the cruise ship industry, and efforts to prevent the loss of and to retrieve derelict fishing gear.[8] Existing programs that can aid in the control of marine debris from land-based sources are those that focus on litter reduction, storm water pollution control, and solid waste reduction.

Overview of Actions Recommended

This Plan contains actions to address the land-based discharges of marine debris. It includes actions to create state agency leadership in the control of litter and marine debris, and a more coordinated approach among state agencies and stakeholders in addressing these problems. Additional research is needed to support more informed responses to marine debris problems in California. Actions to address research needs focus on better understanding of: (1) the product composition of trash and debris in urban runoff, (2) the environmental impacts of micro-plastic debris and the additives it contains, and (3) the effects the persistent organic chemicals and invasive species that attach to the debris and are thereby transported through the marine environment.

The Plan recommends actions to address specific sources of land-based discharges. In terms of littering by the general public and beach visitors, the Plan recommends actions that increase: (1) physical control of litter (receptacles and collection); (2) education to prevent littering; and (3) enforcement of existing laws to prevent littering.

Actions in the Plan recommend reducing littering by recreational boaters and fisherman. These actions include assuring that adequate services and facilities are in place to support proper waste management

[8] MARPOL 73/78 (the International Convention for the Prevention of Pollution from Ships) is the international treaty regulating disposal of wastes generated by normal operation of vessels. MARPOL 73/78 is implemented in the U.S. by the Act to Prevent Pollution from Ships, under the lead of the U.S. Coast Guard. 161 countries are parties as of December 2001.The treaty consists of 20articles and 5 annexes. Annex V addresses the disposal of garbage from ships and includes a provision preventing the disposal of plastic at sea. http://www.epa.gov/OWOW/OCPD/marpol.html

by boaters at marinas, ports, boat launch ramps, boat rental facilities, and fishing areas. Additional actions focus on increasing education and outreach to boaters and enforcement of laws preventing the improper disposal of trash. Similarly, ports and commercial shipping are recognized as areas where, if proper shore-side services are available, improper disposal at-sea can be reduced, especially where port fees are not structured to encourage at-sea disposal.

CATEGORIES OF ACTIONS RECOMMENDED

- Improve coordination
- Increase research
- Decrease litter
- Control construction debris
- Improve garbage management
- Achieve zero discharge of pre-production plastics
- Decrease product and packaging waste

The construction and garbage management industries are also identified as areas that contribute to trash and debris discharges. Methods for encouraging good housekeeping practices at construction sites and commercial and industrial establishments are among the recommendations in the Plan. Similarly, many recommendations are included to promote the use of good housekeeping practices to prevent the discharge of pre-production plastic pellets and powders from plastics manufacturing and industrial facilities.

The Plan also contains actions recommended to address product waste, as it is product waste that is the major component of trash in urban runoff. Several actions are suggested for reducing the amount of waste requiring disposal. These include: reducing the amount of single use and disposable products that consumers use; increasing recycling of bags, packaging and containers; imposing bans and limits on the use of specific products that contribute to marine debris and litter; and promoting source reduction in schools and communities.

The Plan calls for reducing the quantity of municipal solid waste generated in California because municipal solid waste contains the product and packaging waste that become litter. The Plan contains recommendations for investigating new strategies for waste management, such as extended producer responsibility and shared responsibility models currently employed in Europe and many nations around the world, to determine which models are most likely to result in reducing the amount of waste generated and littered.

The Plan includes actions to change product packaging such that it becomes less prevalent in the marine environment. Actions recommended include developing standards for environmentally preferable packaging, redesigning packaging for reducing the volume of waste generated, and studying the merits of compostable and degradable litter.

Options for funding many of the actions recommended in this Plan include litter fees or taxes associated with products that are significant components of litter and marine debris. Bond measures, similar to the bond measure financing stormwater pollution control in Los Angeles County, are another option. Various types of fees can be levied to raise money for implementing solutions, including advanced disposal fees, litter enforcement fees, redemption fees for recycled products, and increased garbage tipping fees. The Plan discusses options in general but does not make recommendations as to particular options for accomplishing particular recommendations. It leaves the determination as to funding mechanism to the “potential implementers” for each recommended action.

Immediate Priorities

The Plan was developed with the assistance of a Marine Debris Work Group whose participants represent the "potential implementers" identified throughout the Plan. The Work Group identified several ACTIONS RECOMMENDED as immediate priorities – actions that must be implemented in order to allow further work to proceed on effective implementation of other actions suggested in this Plan.

(A) CREATE A PERMANENT MARINE DEBRIS PROGRAM IN THE STATE

1. ***Create a State Mandate to Reduce Marine Debris and Litter Vested in One or More Agencies.*** In order to assure that these actions or similar ones are implemented, one or more state agencies must be tasked with overseeing a coordinated program to eliminate marine debris and litter.
2. ***Provide Permanent Funding for the Program.*** Permanent funding is required both to complete the necessary background research and for coordination and oversight to facilitate implementation of many of the ACTIONS RECOMMENDED. The funding should also provide grants to local governments and regional programs to aid in implementation of the actions recommended in this Plan. Some options for funding include:
    - A marine litter bond
    - Fee(s) or taxes attached to products that are significant components of marine debris and litter
    - Enforcement activities and associated fines
3. ***Develop an Interagency Task Force on Litter and Marine Debris.*** The tasks of eliminating marine debris and litter relate to the programs of several State agencies. An Interagency Task Force should be developed in order to assure that the appropriate coordination and implementation occurs. These agencies include the: CCC, California Department of Boating and Waterways (DBW), California Department of Conservation (DOC), California Department of Transportation (CalTrans), California Integrated Waste Management Board (CIWMB), California State Parks (CSP), Ocean Protection Council, State Water Resources Control Board (SWRCB), San Francisco Bay Conservation and Development Commission, and State Coastal Conservancy.

The Task Force should be initiated at the agency director level and should have the authority to spend, manage, and implement funds to deal with marine debris.

(B) CONDUCT RESEARCH NEEDED TO INFORM FUTURE ACTIONS AND TO INVESTIGATE UNKNOWN IMPACTS OF MARINE DEBRIS

1. ***Identify litter and marine debris "hot spots."*** Geographic "hot spots" for litter and marine debris must be identified in order to prioritize the location of efforts to reduce marine debris.
2. ***Identify the product composition of trash in urban runoff and litter.*** Several of the actions recommended in this Plan require information about the product composition of litter and marine debris in California. Existing research does not adequately characterize trash in urban runoff or litter such that actions can be taken to address the most common items of marine debris or the most "litter prone" products.
3. ***Investigate the impacts on marine eco-systems of (1) micro-plastics, (2) plastic additives, (3) rafting marine species, and (4) pollutants adsorbed and absorbed by plastic fragments.*** Recent research cited in this Plan documents that plastic debris in increasingly smaller sizes is becoming more prevalent in the ocean. New research also shows that plastic particles absorb and adsorb pollutants from waterways and transport them. Floating plastic particles also transport marine organisms that attach themselves to debris and migrate. Plastics contain additives, some of which are considered hormone-disrupters that have the potential to be released in the marine environment. Concerns about the potential of plastics to adversely impact the marine environment via these four mechanisms require further investigation.

4. ***Conduct preliminary research needed to develop a state-wide anti-litter campaign.*** Research is needed to identify why people litter and what would motivate them to stop littering. This research should be conducted within each marine debris and litter "hot-spot," per recommendation B (1).

Other Significant Recommendations for Action in the Plan

INCREASE ANTI-LITTER ENFORCEMENT AND EDUCATION

A few strategies received broad support among the stakeholders involved in the development of this Plan. These include increasing anti-litter enforcement and education. Several other state and local anti-litter and marine debris
programs have already implemented these strategies with good results.

1. ***Increase State and local enforcement of anti-litter laws as a deterrent to the most litter-prone segments of the population.*** Litter is identified as one of the most serious contributors to the marine debris problem. The Plan provides many recommendations for reducing litter. It is widely believed that increased enforcement of anti-litter laws will have a deterrent effect on littering. Cigarette butts are among the most prevalent forms of beach litter and marine debris and therefore require particular attention with respect to enforcement.
2. ***Increase education about litter and marine debris.*** Actions are recommended for anti-litter education for beach visitors, cigarette smokers, boaters, pedestrians, motorists, and commercial establishments. Education and outreach efforts must be expanded. Significant increases in funding for public education are needed to increase anti-litter and anti-marine debris education. The Plan suggests a coordinated state-wide effort to educate the public about marine debris and litter. A well-coordinated effort should target trash "hot-spots' first and foremost, and should integrate existing local outreach.

DECREASE THE QUANTITY OF PRODUCT AND PACKAGING WASTE GENERATED IN CALIFORNIA

The Plan suggests actions for reducing the quantity of litter-prone waste generated in California. Although industry does not necessarily subscribe to this view, many participants in the development of this Plan believe that the increase in debris in the marine environment is linked to the increasing quantity of disposable products.

Introduction

Marine debris poses threats to the health of the marine ecosystem, the safety of mariners, and the viability of ocean-dependant industries. Despite past efforts to control marine debris, the quantity of debris in oceans and on beaches is increasing dramatically world-wide. It is time to get serious about eliminating marine debris. The strategy suggested in this Plan is to address the most significant sources of marine debris first. In terms of composition of marine debris, the most significant source is plastic. In terms of activities that result in marine debris, land-based activities (including littering, industrial discharges of plastics, and storage and movement of garbage) are the most significant sources of marine debris.

The California Marine Debris Action Plan of 1990

Fifteen years ago, in recognition of the growing marine debris problem, the Center for Marine Conservation (now The Ocean Conservancy), formed a task group to develop an Action Plan for California. *The California Marine Debris Action Plan of 1990* made 22 recommendations for reducing marine debris. The recommendations focused on addressing enforcement of existing laws, educating the public, conducting more research, and enacting new legislation. There was no coordinated effort to oversee the Plan's implementation. Only a few of the Plan's recommendations were implemented.

The 1990 Plan reflects the level of understanding of the problem and potential solutions at that time. For example, at that time, the marine debris problem was considered a problem stemming mostly from ocean-based activities, and the recommendations of that Plan reflect that point of view. Since then, research has changed our understanding of the problem and the range of options for addressing it.

A State Mandate to Eliminate Marine Debris is Necessary

One of the reasons that no coordinated effort to reduce marine debris followed the publication of the 1990 Plan is that in California there is no single agency charged with either litter prevention or marine debris prevention as its goal. Similarly, at the federal level, there is no specific legal or regulatory mandate for states to reduce marine debris or prevent litter. Currently in California, the elimination of marine debris requires simultaneous efforts to eliminate littering, properly manage solid waste, stop industrial discharges of synthetic debris to state waters, and reduce the quantity of solid waste being generated. Therefore, marine debris is an issue that involves multiple strategies ranging in focus from marine debris and ocean protection to storm water pollution control and solid waste management. Without a mandate and funding to ensure that litter prevention and marine debris control measures are implemented and well coordinated, efforts to reduce marine debris will likely be piecemeal and fail to address many of the most important needs.

The Plastic Debris, Rivers to Sea Project

The *Plastic Debris, Rivers to Sea Project* is a grant-funded research and education program developed and implemented by AMRF and the CCC. The Project received substantial funding from the SWRCB through a Proposition 13 grant. The primary goal of the project is to reduce the land-based discharges of plastics and other discarded materials that degrade water quality and impair beneficial uses of inland and

coastal waters. The degree to which small plastic fragments from consumer products and plastic pellets discharged by the plastics industry represent a pollutant originating from land-based sources has been a primary focus of past research conducted by AMRF.

The Project tested the effectiveness of current industry-generated Best Management Practices, a program known as Operation Clean Sweep, to control discharges of plastic debris from the plastics manufacturing sector. In addition, AMRF's research and monitoring in the Los Angeles and San Gabriel River watersheds provided a snapshot understanding of the quantity and nature of small plastic debris flowing from these watersheds to the ocean.

Other project initiatives designed to facilitate increased dialogue and awareness among government agencies, industry, and environmental organizations about the impacts and potential solutions to plastics and other discarded materials in urban runoff included:

- *Plastic Debris, Rivers to Sea Conference* – September 7–9, 2005
- The Plastic Debris, Rivers to Sea Network
- *Plastic Debris, Rivers to Sea* – a DVD about the Project issues
- Development of a website devoted to plastic debris issues – www.plastidebris.org

The Action Plan

This Action Plan is one of the products of the *Plastic Debris, Rivers to Sea Project*. It identifies different land-based activities and behaviors that contribute plastics and other discarded materials to the marine environment and suggests actions to stop the flow of these materials to local waterways and coastal areas.

The Plan is intended to be both an educational document and a tool for engaging stakeholders in planning future actions that will help solve marine debris problems in California.

The Actions Recommended in this Plan – Process and Prioritization

Developers of the Plan engaged a diverse group of public and private organizations, viewed as "potential implementers" of the types of actions that were envisioned at the outset, in the process of developing the Plan. The "potential implementers" formed a Marine Debris Work Group. During the process, Work Group participants were asked to identify actions that could be included in their current or future program goals.

Two workshops were held and three drafts were circulated to gain input from Work Group participants. If a participant felt that an action was necessary, it was included in early drafts of the Plan or incorporated with other actions recommended. During the second workshop, the Work Group was asked to rate the importance of each action recommended in the draft Plan, and as a result, some actions that were not deemed to have potential to result in significant change were not included in the final Plan. In addition, the development of the Plan was informed by feedback from the Project Advisory Board, and participants in the *Plastic Debris, Rivers to Sea Conference*.

Developers of the Plan decided that the Plan would represent a comprehensive approach to solving land-based marine debris problems by including actions that might be taken by a wide variety of stakeholders in California. As a result, the Plan reflects multiple approaches and opinions about the solutions to marine debris. It is not streamlined to recommend only actions for which a consensus of opinion was reached. The Plan was not developed as a hierarchy of priority actions, although some immediate priorities were developed, as discussed below. Essentially, it is a broad ranging Action Plan published with the hope that all "potential implementers" will act and a multiplicity of actions will result.

Not all participants in the Marine Debris Work Group agree with all the actions recommended in this Plan. For example, industry representatives took issue with the actions that would prohibit, tax, or ban products; require design changes in products and packaging; or dramatically change the structure of solid waste management in the State.

PART I

Marine Debris – Sources, Composition, and Quantities

What is Marine Debris?

Marine debris has been defined as any manufactured or processed solid waste materials that enter the ocean environment from any source.[9] It generally includes debris that floats, remains suspended in the water column, or sinks to the ocean bottom. Marine debris is also a term that is used to describe man-made debris that litters beaches.[10] Marine debris is a problem that affects beaches/coastlines throughout the world and all depths of the ocean including the seafloor.[11] Its impact is of global significance.

Land Versus Ocean Sources

Sources of marine debris have been characterized in several investigations.[12] Some characterize sources in terms of specific activities or operations that convey trash and debris to the marine environment while others describe them in terms of the materials that comprise marine debris (plastic, glass, paper, etc.). In this report, activities or operations are characterized as *sources*; discussion of products, items or materials refers to the *composition* of marine debris.

Sources of ocean-based discharges of marine debris are generally recognized as:

- Commercial fishing vessels
- Cruise ships
- Cargo ships
- Recreational vessels
- Military ships[13]

Land-based sources of marine debris generally include:

- Urban runoff
- Combined sewer overflows
- Beach visitors
- Solid waste disposal and garbage management
- Industrial activities
- Ports and marinas
- Construction
- Illegal dumping or littering

Urban runoff is the primary source of marine debris.[14] The major source of trash in urban runoff results from litter, which is intentionally or accidentally, discarded in watershed drainage areas. Transport mechanisms include the following:

[9] Coe, J & Rodgers, D.B, Eds., *Marine Debris: Sources, Impacts and Solutions*, (1997) Springer-Verlag: New York, 432.

[10] Seba Sheavly, "Beach Debris-Characterized through the International Coastal Cleanup & the U.S. National Marine Debris Monitoring Program," presented at *Plastic Debris, Rivers to Sea Conference*, September 7-9, 2005. www.plasticdebris.org.

[11] Allan T. Williams, Murray T. Gregory, M, D.T. Tudor, "Marine Debris- Onshore, Offshore, Seafloor Litter," 2005. *Encyclopedia of coastal processes*, (ed.), M Schwartz, p. 623, Springer.

[12] Examples can be found in: U.S. EPA, August 2002. *Assessing and Monitoring Floatable Debris*, Washington, D.C. p. 2-2; Williams et al.

[13] Id. at 623.

[14] Los Angeles Regional Water Quality Control Board, *Trash TMDLs for the Los Angeles River Watershed*, (September 19, 2001): 17.

1. Storm drains and waterways: trash is deposited throughout the watershed and is carried by wind and water to storm drains and waterways during and after significant rainstorms
2. Wind action: trash can also blow into the waterways directly
3. Direct disposal: direct dumping also occurs

The large quantity of trash conveyed by urban storm water to the Los Angeles River is evidenced by the amount of trash that accumulates at the base of storm drains. The amount and type of trash that is washed into the storm drain system appears to be a function of the surrounding land use.[15]

Abundance of Plastic in the Marine Environment

Plastic is the most common type of marine litter world-wide.[16] Globally, the proportion of plastic among marine debris world-wide ranges from 60 to 80%, although it has reached over 90–95% in some areas.[17] Plastics comprise up to 90% of floating marine debris.[18]

Although known for its impacts as floatable debris, plastic debris is also prevalent on the seafloor. Studies of the beaches and ocean bottom in Southern California found that plastic materials are the most common type of human-made debris in the region.[19] In 1995, plastics comprised 80-85% of the seabed debris in Tokyo Bay.

AMRF's 1999 study of marine debris in the Mid-Pacific Gyre, collected plankton samples from the ocean surface at various locations throughout the gyre. The results showed the mass of plastic particles collected was six times higher (5,000 g/km2) than the mass of plankton (841 g/km2), although the number of planktonic organisms (1,837,342/km2) was five times the number of plastic pieces. In this study, the most common type of identifiable particle, thin plastic film, accounted for 29% of the total.[20]

Quantities of Plastic Debris Are Increasing Significantly in Oceans

The quantities of plastic in ocean waters world-wide are increasing significantly. Within the Southern Atlantic Ocean, the amount of debris increased 100-fold during the early 1990s.[21] In the coastal areas of Japan during the 1970s to 1980s, marine plastic-particle densities increased ten fold every ten years. However, in

[15] Id.

[16] J.G.B. Derraik, at 843; Gregory et al at 49-66

[17] Id.

[18] United Nations Environment Programme, GPA Coordination Office, *Marine Litter–Trash that Kills*, www.gpa.unep.org; http://marine-letter.gpa.unep.org/facts/what-where.htm

[19] S. Moore

[20] C.J. Moore, S.L. Moore, M. K. Leecaster, S.B. Weisberg, "A Comparison of Plastic and Plankton in the Pacific Central Gyre," *Marine Pollution Bulletin*, 42 (2001): 1297-1300.

[21] Sofia Copello and Favio Quintara, "Marine debris ingestion by Southern Giant Petrels and its potential relationships with fisheries in the Southern Atlantic Ocean," *Marine Pollution Bulletin* 46 (2003): 1513-1515.

the 1990s, densities appear to have increased ten fold every two–three years.[22] Micro plastics in the North Pacific have tripled during the last decade.[23]

Researchers at the University of Plymouth (UK) showed that particles as small as 20 µm in diameter are now common in marine sediments and in the water column. They also demonstrated that the abundance of this type of debris had increased significantly over the last 40 years. A range of common polymers was identified indicating that the microscopic particles probably formed by the breakdown of larger items. They concluded that their "findings demonstrate the broad spatial extent and accumulation of this type of contamination. Given the rapid increase in plastic production, the longevity of plastic, and the disposable nature of plastic items, this contamination is likely to increase."[24] The environmental consequences of this debris are not known, but when kept in aquaria amphipods (detritivores), lugworms (deposit feeders), and barnacles (filter feeders) all ingested microscopic particles within a few days.[25]

Sources and Composition of Debris Found on Beaches

Beach litter is an indication of the composition of marine debris, since some of the litter has been deposited by tides and some will be swept out to sea by tides. The Ocean Conservancy (TOC) has been conducting two different evaluations of beach debris: (1) the data analysis of debris collected each year during International Coastal Cleanup (ICC), and (2) the National Marine Debris Monitoring Program (NMDMP).[26]

The ICC data is collected by volunteers on one day each year, and is not a scientific assessment. However, many years of data show definite trends. For example, an average of 60% of the debris items retrieved from beaches on CCD in the U.S. is comprised of plastic materials. The primary items of debris from land-based sources on the Pacific Coast collected during the ICC include food wrappers, beverage containers, cigarettes and smoking-related materials. The primary items of ocean-related debris include fishing nets and gear.[27]

The TOC uses data collected from the ICC to draw inferences about the sources of the debris collected. Data collected during California's Coastal Cleanup Day (CCD) for 2004 revealed the following sources (by number of pieces):

- Shoreline and recreational activities – 48%
- Smoking-related activities – 44.2%
- Ocean waterway activities – 4.5%

[22] Haruo Ogi and Yuri Fukumoto, "A Sorting Method for Small Plastic Debris Floating on the Sea Surface and Stranded on Sandy Beaches," *Bulletin of the Faculty of Fisheries*, Hokkaido University 51(2), 2000 71-93.

[23] Charles Moore, Gwen Lattin, Ann Zellers, "Density of Plastic Particles found in Zooplankton Trawls from Coastal Waters of California to the North Pacific Central Gyre," in *Proceedings of the Plastic Debris, Rivers to Sea Conference*, 2005 www.plasticdebris.org

[24] Thompson, R.C. at 304.

[25] Id.

[26] Sheavly, S.

[27] Sheavly, S. at p.17.

- Dumping activities – 2.8%
- Medical / personal hygiene – 0.5%[28]

The data collected during the 2004 ICC event in California indicate that the top 10 debris items (assessed by number of items collected by volunteers) were:

- Cigarettes / cigarette filters – 38.4%
- Food wrappers and containers – 14.1%
- Caps / lids – 7.4%
- Cups / plates/forks/knives/ spoons – 4.9%
- Beverage bottles (glass) – 4.1%
- Bags – 3.8%
- Straws / stirrers – 3.8%
- Building materials – 3.4%
- Beverage bottles (plastic) 2 liters or less – 3.2%
- Beverage cans (metal) – 2.9%[29]

The National Marine Debris Monitoring Program (NMDMP) deploys volunteers to collect beach debris data in a number of U.S. coastal locations, using scientific protocols. The Conservancy's debris analysis from the NMDMP for 2002–2004 indicates that the top land-based debris items were straws, balloons, and beverage cans (metal) while the top ocean-based debris items were rope, floats/buoys, and fishing line. The NMDMP also gathered data for debris from general sources (neither land nor ocean based) for which the top debris items included: plastic bags with seams (<1 meter), beverage bottles (plastic) and other bottles (plastic).[30]

A more localized research effort conducted by the Southern California Coastal Water Research Project (SCCWRP) examined the composition and distribution of beach debris in Orange County.[31] The study estimated that 106 million items, weighing approximately 13 tons, were present on the Orange County beaches in the summer of 1998. The following table summarizes the total abundance and weight of trash on Orange County beaches:

TABLE 1

Estimated total abundance and weight of trash on Orange County Beaches, August to September 1998.[32q]

DEBRIS TYPE	ABUNDANCE	WEIGHT (LBS)
Pre-production plastic pellets	105,161,101	4,780
Foamed plastics	742,296	1,526
Hard plastics	642,020	7,910
Cigarette butts	139,447	344
Paper	67,582	870
Wood	4,554	27,919
Metal	23,500	3,015
Glass	22,195	1,944

[28] The Ocean Conservancy, *International Coastal Cleanup- 2003- California Summary Report*, (2004): 5.

[29] The Ocean Conservancy, p.4. www.coastalcleanup.org

[30] Sheavly, S., at 13.

[31] Shelly L Moore, Dominic Gregorio, M. Carreon, Steven B. Weisberg, and M. Leecaster "Composition and distribution of beach debris in Orange County, California," *Marine Pollution Bulletin*, 42(2001): 241-245.

[32] Id.

DEBRIS TYPE	ABUNDANCE	WEIGHT (LBS)
Rubber	10,742	817
Pet and bird droppings	9,388	17
Cloth	5,949	1,432
Other	10,363	401

Trash and Debris in Storm Water and Urban Runoff

In most of California, storm water and urban runoff flow directly into the marine environment without treatment while sewage goes to a separate sanitary sewage system. In a few older metropolitan areas that have combined storm water and sewer systems, such as San Francisco and Sacramento, debris is released into coastal waters as a result of Combined Sewer Overflows (CSOs). Overflows occur due to equipment malfunction or maintenance or storm events that overwhelm the system's capacity.[33]

Two types of studies aid in an understanding of the contribution of trash in urban runoff to the ocean.[34] One is the direct measurement (using debris collected from booms, nets, and separation, screening, and vortex devices) of debris in urban runoff. Another method for characterizing trash and debris in an urban watershed involves indirect measures of seasonal patterns, such as, beach trash removal, urban refuse trash surveys, and offshore trawl surveys.[35]

The composition of trash found in a catch basin cleanout (a direct measurement approach) from the Los Angeles River in June 2004 was:

- Plastic film and bags – 43%
- Metal – 19%
- Paper – 17%
- Expanded polystyrene foam – 17%
- Metal – 3%
- Cloth – 1%
- Wood – 1%
- Cardboard – 0%
- Glass – 0%
- Cigarette butts – 0%

Volunteer-based beach cleanups (an indirect measurement approach) provide some idea of the type of litter found on beaches and in inland waterways. Measurement of trash in the Los Angeles River conducted in April 2004 by the Friends of the Los Angeles River showed similar results to the catch basin cleanup discussed above. The surrounding land use affects the amounts and types of trash that are transported to waterways from adjacent areas. It is generally accepted that commercial land uses tend to contribute larger loads of gross pollutants per area compared to residential and mixed land-use areas. This is in spite of daily street sweeping in the commercial areas compared to once every two weeks in residential and mixed land use areas.[36]

[33] EPA, *Methods to Manage and Control Plastic Waste, Report to Congress*, February 1990 Office Of Solid Waste and Office of Water EPA/530-SW-89-051- p. 3-16

[34] Shelly Moore, presentation at the *Plastic Debris, Rivers to Sea Conference* on September 8, 2005 "The Contribution of Urban runoff to marine Debris in Southern California." Ms. Moore cites a study of the trash collection from nets and booms; in proceedings of conference, www.plasticdebris.org; S. Moore et al, "Composition and Distribution of Beach Debris in Orange County, California," *Marine Pollution Bulletin*, 42(2001): 3, 241-245; and studies of trash collected from structures such as separation, screening and vortex devices. Other examples of such studies include: Orange County Watershed and Coastal resources Division, July 2000.Debris Characterization Study of the San Diego Creek; Los Angeles County Department of Public Works, Trash Baseline Monitoring Results, Los Angeles River and Ballona Creek Watersheds, May 3, 2004.

[35] S. Moore. Two similar studies are the 2004 "LA River and Long Beach Waste Characterization Study" performed by Friends of the L.A. River and the LA City Bureau of Sanitation.

[36] S. Moore

Other Research Characterizing Trash in Urban Runoff

The information that is most useful in targeting actions to reduce trash and debris from land-based sources characterizes the types of products and specific items flowing from inland areas to the ocean, such as, food containers and shopping bags. These products imply an associated activity and venue for which actions can be designed. As indicated by this report's research recommendations, this type of investigation needs to be performed for individual municipalities or regions as litter varies by region.[37]

One study that identified debris in this manner allowed the community to engage specific business groups and consumer groups in an education and source reduction program.[38] The Oxnard Storm Drain Keeper program assessed trash captured from the storm drain system in 2003 and 2004 and identified the debris both in terms of material composition and also in specific categories of product use: household items, personal effects, sports equipment, automotive, landscape, paper products, plastic and cellophane, expanded polystyrene foam, glass, aluminum/metal, animal carcasses, and hazardous materials. In addition, the paper and expanded polystyrene foam debris, which tended to be comprised of name brand packaging, was categorized by name brands. As a result, the City was able to demonstrate to local businesses their role in the marine debris issue and worked successfully with these businesses to implement programs that reduced the volume of trash and litter.

Distribution and Composition of Marine Debris on California's Coast

During the last ten years, SCCWRP and AMRF have conducted studies to quantify marine debris in four habitats: the beach, the ocean bottom, the ocean water column, and the ocean surface. Debris was found in all four habitats, but the types of debris differed considerably among them. The ocean bottom is dominated by larger material, such as beverage containers and fishing gear, whereas the water column contains mostly plastic fragments that are small enough to be suspended by ocean currents. The ocean surface contains both fragments and identifiable articles of marine debris. The beach habitat contains a combination of materials that differ in size and composition according to distance from the water's edge. Thus, the environmental impacts associated with the debris will vary by habitat with aesthetic issues being more important on beaches, and food web concerns being more prevalent for the small neustonic[39] material.[40]

[37] Comment letter (November 16, 2005) from Shahram Kharaghani, Program Manager, City of Los Angeles Department of Public Works, Bureau of Sanitation.

[38] Mark Pumford, City of Oxnard, presentation at the *Plastic Debris, Rivers to Sea Conference* September 8, 2005. In proceedings www.plasticdebris.org

[39] Living on or under the surface film of open water.

[40] Abstract for presentation provided by Stephen B. Weisberg, Southern California Coastal Water Research Project, at the *Plastic Debris, Rivers to Sea Conference*, September 7-9, 2005.

PART II

Impacts of Marine Debris

Some of the qualities that make plastic desirable from a product standpoint are the same qualities that make it hazardous from a marine debris standpoint: it is durable and light-weight. Plastic can travel vast distances and accumulate on beaches and in the ocean. The persistence of plastic debris in the marine environment results in detrimental impacts over long periods of time. The same plastic fishing net can trap marine mammals and fish for many decades. Eventually, plastic will photodegrade, breaking into smaller pieces. These pieces also pose hazards, as marine animals ingest them.

It is unclear whether plastic ever breaks down to the point of fully disappearing in the ocean. The duration of existing research on the presence of plastic in the marine environment has not been long enough to document its disappearance. Some researchers feel that the composition of conventional petroleum-based plastics, as durable polymers, makes it unlikely that such materials will disappear. It is more likely that they will degrade to increasingly smaller sizes.[41] Many researchers believe it will take, at a minimum, several centuries (up to a millennia) to fully degrade.

Because of its persistence in the marine environment, plastic debris is the primary material that harms sea life. Large pieces of plastic debris are known to cause a range of impacts to marine wildlife. The results of many of the studies documenting these impacts should be viewed as conservative based on the age of much of the data.

Although there is recent research on the impacts of marine debris, particularly with respect to seabirds, a comprehensive review of the impacts of marine debris on marine life has not been performed in recent decades. In light of more recent research demonstrating the increasing abundance of micro-plastics, future research regarding the impacts of plastic debris is likely to present a better understanding of the impacts of small (even microscopic) plastic debris.

[41] H. Kanehiro, T. Tokai, K. Matuda, "Marine litter composition and distribution on the seabed of Tokyo Bay," *Fisheries Engineering* 31 (1995): 195-199.

Ingestion and Entanglement

In the ocean, plastic debris can cause injury or fatality to fish, seabirds, and marine mammals. Marine debris is known to have affected at least 267 species world-wide, including 86% of all sea turtle species, 44% of all seabird species, and 43% of marine mammal species, primarily through ingestion, starvation, suffocation, infection, drowning, and entanglement.[42] In the 1980s, researchers estimated that there were 100,000 marine mammal and sea turtle deaths per year in the North Pacific related to entanglement in plastic nets and fishing line.[43]

Many of the surface feeding species such as albatrosses, petrels, and fulmars, which forage on a broad range of fish and squid prey, are especially prone to ingesting plastic debris. In particular, large seabirds such as Laysan and Black-footed albatrosses, and Northern Fulmar, frequently ingest a variety of large-sized items such as bottle caps, cigarette lighters, toys, party balloons, and fragments of broken plastic consumer goods. Adults feed these items to their young, resulting in detrimental effects on chick growth and survival.[44] Other species that capture zooplankton – such as phalaropes, shearwaters, and auklets – ingest small-sized (few millimeters long) fragments of user plastics and pre-production industrial plastic pellets.[45]

Researchers have found that 97% of Fulmars in the North Sea were affected by plastic ingestion, on average about 50 pieces per bird.[46] During a seabird die-off on the central California coast in 2002–2003, researchers examined the stomach contents of 190 Northern Fulmars and three Red Phalaropes, and determined plastic fragments occurred in 71% of the fulmar and 100% of the phalarope stomachs.[47] A pilot study at Kure Atoll in 1999–2000 revealed that all (100%) the pellets regurgitated by chicks contained plastic.[48]

The significant contribution of small plastic debris floating through the Los Angeles River and San Gabriel River watersheds and out to the Pacific Ocean was first identified and more recently quantified by AMRF.[49] Fragments of plastic products that degrade when exposed to sunlight, as well as plastic resins (in the form of pellets) used as feedstock material in the manufacturing

[42] D.W. Laist, "Impacts of marine debris: entanglement of marine life in marine debris including a comprehensive list of species with entanglement and ingestion records" In Coe, J.M., Rogers, D.B. (Eds.), *Marine Debris–Sources, Impacts, and Solutions*: Springer-Verlag, New York, (1997) 99-139.

[43] N. Wallace. "Debris entanglement in the marine environment: A review" (1985) pp. 259-277 in: R.S. Shomura and H.O. Yoshida (eds.), *Proceedings of the Workshop on the Fate and Impact of Marine Debris*, U.S. Department of Commerce, NOAA Technical Memorandum. NMFS, NOAA-TM-NMFS-SWFC-54.

[44] Hannah Nevins et al, "Seabirds as indicators of plastic pollution in the North Pacific," presented at the *Plastic Debris, Rivers to Sea Conference*, September 8, 2005. Available at www.plasticdebris.org

[45] Id.

[46] J.A. Van Feneker et al, "Save the North Sea Fulmar Study 2002-2004 a regional pilot project for the Fulmar-Litter-EcoQO in the OSPAR area," Alterra Institute, 2005. Available at: http://www.alterra.wur.nl/NL/

[47] Nevins et al.

[48] Id. at 6.

[49] Charles Moore, Gwen Lattin, Ann Zellers, "Density of Plastic Particles found in Zooplankton Trawls from Coastal Waters of California to the North Pacific Central Gyre," in *Proceedings of the Plastic Debris, Rivers to Sea Conference*, 2005 www.plasticdebris.org

of plastic materials, have been discovered on beaches, in open ocean samples, and in the water column throughout the world.

Ecosystem Impacts

As a result of increased reports of resin pellet ingestion by aquatic wildlife and evidence that the ingested pellets are harming wildlife, the Interagency Task Force on Persistent Marine Debris (ITF), identified resin pellets as debris of special concern.[50] After extensive investigation of plastic processing facilities in California, AMRF is concerned not only about the impacts of pellets, but also much smaller plastics discharged through wind and storm drains to nearby waters. These include resin powders, powdered coloring and other plastic additives, and regrind materials.

When released into the environment, pellets float on or near the water surface, become suspended at mid-depths, or sink to the bottom of a water body. Whether a specific pellet floats or sinks depends on the type of polymer used to create the pellet, on additives used to modify the characteristics of the resin, and on the density of the receiving water.[51] The accumulation of plastic debris on the seafloor can inhibit the gas exchange between overlying waters and the pore waters of the sediments, causing benthic hypoxia or anoxia that can interfere with normal ecosystem functioning and alter life on the sea floor.[52]

Trash in inland waterways causes significant water quality problems. Floatable debris can inhibit the growth of aquatic vegetation, decreasing spawning areas and habitats for fish and other living organisms. Wildlife living in rivers and in riparian areas can ingest or become entangled on floating debris. Heavier debris that settles on the bottom of a water body includes glass, cigarette butts, rubber, construction debris and other items. The heavier debris can impact bottom feeders and dwellers and can contribute to sediment contamination. Benthic debris interferes with gas transpiration between the water column and the benthos and disturbs the benthic food web.[53] Some types of debris (e.g. diapers, medical and household waste, and chemicals) are sources of bacteria and toxic substances.[54]

[50] US Environmental Protection Agency (1992) *Plastic Pellets in the Aquatic Environment: Sources and Recommendations*. The White House Domestic Policy Council formed the ITF in 1989. It was chaired by NOAA and included 12 federal agencies, including the U.S. EPA. The ITF was directed to: assess the problem of persistent marine debris and the need for research, identify potential reduction measures, and consider alternative actions to address the problem of plastic marine pollution.

[51] Id.

[52] E.D. Goldberg, "Diamonds and plastics are forever?" *Marine Pollution Bulletin* 28 (1994): 466.

[53] E.D. Goldberg, "Plasticizing the seafloor: An overview," *Environmental Technology* 18 (1997:195-201.

[54] Los Angeles Regional Water Quality Control Board.

Debris as a Transport Mechanism for Toxics and Invasive Species

Evidence that plastic debris is a transport mechanism for toxic substances in the marine environment and waterways raises additional concerns over potential impacts to marine ecosystems, since marine animals ingest plastic fragments and pellets. Additional research is needed to determine if these toxic chemicals are contaminating marine food chains.

Marine plastic resin pellets carry two types of organic micropollutants, plastic additives and pollutants adsorbed from ambient seawater.[55] Additive-derived pollutants are the chemical plastic additives (e.g., anti-oxidants) and their degradation products. One type of additive, nonylphenols, was detected in plastic resin pellets collected from Japanese coasts.[56] Another type, phthalates, was discovered in all field samples from the Los Angeles and San Gabriel River watersheds during studies carried out by AMRF during the Project.[57] Nonylphenols and phthalates exhibit endocrine disrupting effects in some marine species.[58]

Pollutants that are adsorbed onto marine plastic pellets from ambient seawater include: polychlorinated biphenyl (PCBs), dichloro-diphenyl-dichloroethylene (DDE; a degradation product of the organochlorine pesticide, DDT), and polycyclic aromatic hydrocarbons (PAHs). Concentrations of PCBs and DDE on marine plastic resin pellets collected from Japanese coasts were found to be up to 1 million times higher than the levels detected in surrounding seawater.[59] Similarly, analysis of pellets found in the Los Angeles and San Gabriel River watersheds (beach and river samples) conducted by AMRF found PAHs in similar concentrations on pellets and plastic fragments.[60] Concentrations of PAHs on the pellets collected in Southern California rivers are comparable to those found in storm water in the same locations (around 2.5 ppb). This is consistent with the conclusions of Mato et al., who found that resin pellets from industrialized areas contained larger amounts of PCBs than those from a remote site. They concluded that the contaminant levels in the surrounding environment determine contaminant concentrations in resin pellets.[61]

Floating and migrating plastic debris also transport invasive and alien species. The larvae of invasive species may attach to floating debris and be transported to habitats where they don't belong.[62] Plastics have been shown to acquire a variety of passenger organisms, such as bacteria, diatoms, algae, barnacles, hydroids, tunicates, and some species of bryozoans.[63] The arrival of unwanted alien species can be detrimental to littoral, intertidal, and shoreline ecosystems.[64]

Economic Impacts

Marine debris can cause various types of economic harm. Damage to boat propellers and seawater intakes has been documented. Although economic loss related to beach litter has not been studied in California,

[55] Hideshige Takada, et al., Tokyo University of Agriculture and Technology, "Pellet Watch: Global Monitoring of Persistent Organic Pollutants (POPs) using Beached Plastic Resin Pellets," paper presented at *Plastic Debris, Rivers to Sea Conference* September 7–9, 2005. In proceedings: www.plasticdebris.org

[56] Y. Mato, et al, "Toxic chemicals contained in plastic resin pellets in the marine environment -spatial difference in pollutant concentrations and the effects of resin type," *Kankyo Kagakukaishi* 15(2002): 415-423.

[57] Charles Moore, Gwen Lattin, Ann Zellers, "A Brief Analysis of Organic Pollutants Sorbed to Pre and Post-Production Plastic Particles from the Los Angeles and San Gabriel River Watersheds," presented at *Plastic Debris, Rivers to Sea Conference* September 7-9, 2005. In proceedings: www.plasticdebris.org

[58] Jobling, S., et al, "Inhibition of testicular growth in rainbow trout (Oncorhynchus mykiss) exposed to estrogenic alkylphenolic chemicals," *Environmental Toxicology and Chemistry* 15 (1996): 194-202.

[59] Mato, Y. et al

[60] Charles Moore, Gwen Lattin, Ann Zellers, "A Brief Analysis of Organic Pollutants Sorbed to Pre and Post-Production Plastic Particles from the Los Angeles sand San Gabriel River Watersheds," presented at *Plastic Debris, Rivers to Sea Conference* September 7-9, 2005 In proceedings: www.plasticdebris.org

[61] Id.

[62] David Barnes, "Biodiversity: Invasions by Marine Life on Plastic Debris," 416 *Nature*, 6883 (April 25, 2002): 808-809.

[63] Derraik, J.G.B. at 847.

[64] Gregory, M.R., "The hazards of persistent marine pollution: drift plastics and conservation islands," *Journal of the Royal Society of New Zealand* 21 (1991): 83-100; Gregory, "Plastics and the South Pacific island shores: environmental implications," *Ocean and Coastal Management* 42 (1999): 603-615.

since tourism is a major contributor to the California economy, and beaches and scenic coastal areas are a major source of tourism in the State, it would be valuable to assess the potential impact of littered beaches and waterways on the tourism economy. In 2000, tourism generated 12 billion of the Gross State Product (GSP) in California, comprising 58% of the 2000 GSP when compared to other coastal industries (transportation, ship and boatbuilding, minerals, living resources, and construction).[65]

Studies estimated economic losses due to major debris incidents of 1987 and 1988 when debris washed ashore on the Atlantic Coast after being released from the Fresh Kills landfill in New York. One study reported that an estimated $1 billion were lost during those two summers because of decreased tourism along the Jersey shore.[66] It is unclear how relevant the experience of the Fresh Kill Landfill contamination of New York and New Jersey beach communities is to California's coastal communities, as the debris was from a landfill perhaps different in quantity and character than marine debris along California's coastal zone. However, the incident provides clear evidence that significantly littered beaches can deter tourism and result in serious economic hardship to coastal communities

[65] National Ocean Economics Program, *California's Ocean Economy*, July 2005, p. 2.

[66] EPA, *Methods to Manage and Control Plastic Waste, Report to Congress*, (February 1990) Office Of Solid Waste and Office of Water EPA/530-SW-89-051- 3-66.

PART III

Current Efforts to Address Marine Debris

Programs in California that address marine debris tend to be piecemeal, focusing on one component or source of the problem, or one particular solution. There are currently no programs that deal with the issue in a comprehensive way, incorporating all sources and all solutions. Currently, marine debris is addressed through: (1) educational programs focusing either on litter prevention or storm water pollution; (2) trash and debris collection and cleanup on streets, highways, and beaches and in waterways and storm drains; (3) bans and prohibitions on the use of certain materials such as polystyrene food containers, or smoking at beaches; (4) local anti-litter enforcement; and (5) State regulation of storm water discharges. These efforts are implemented by a wide array of agencies and organizations.

This section provides information about governmental, industry, and nonprofit organization programs that address marine debris within California. It is not comprehensive. There are many local government and nonprofit efforts and initiatives addressing storm water, litter, and solid waste issues in California. The programs listed here are those that have been recognized by the Project as result of their involvement in the development of the Plan, or as participants in the Project or *Plastic Debris, Rivers to Sea Conference*.

Federal Programs and Initiatives

IMPLEMENTATION OF MARPOL

The United States ratified Annex V of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78).[67] Annex V prohibits the at-sea disposal of plastic and regulates the distance from shore from which ships may dump all other solid materials. The Marine Plastic Pollution Research and Control Act (MPPRCA) of 1987 (Public Law 100-220, Title II) implements the Annex V legislation and extends the dumping regulations to vessels in all navigable waters within the United States. As a result the National Oceanic and Atmospheric Administration (NOAA) was directed by Congress to establish an interagency Marine Debris Coordinating Committee and develop a federal marine debris information clearinghouse. Section 2204 of the MPPRCA directs the United States Environmental Protection Agency (U.S. EPA), NOAA, and the U.S. Coast Guard to jointly conduct a public education program on the marine environment. While MARPOL relates specifically to at-sea disposal of plastic, these agencies were to encourage volunteer groups to assist in the monitoring, reporting, cleanup, and prevention of marine debris.

[67] MARPOL 73/78 (the International Convention for the Prevention of Pollution from Ships) is the international treaty regulating disposal of wastes generated by normal operation of vessels. MARPOL 73/78 is implemented in the U.S. by the Act to Prevent Pollution from Ships, under the lead of the U.S. Coast Guard. 161 countries are parties as of December 2001.The treaty consists of 20articles and 5 annexes. Annex V addresses the disposal of garbage from ships and includes a provision preventing the disposal of plastic at sea. http://www.epa.gov/OWOW/OCPD/marpol.html

This approach – focusing on volunteer cleanups, monitoring, and education – has been the foundation of U.S. efforts to control marine debris since 1987.

THE NATIONAL MARINE DEBRIS MONITORING PROGRAM

In 1990, the U.S. EPA was required by Congress to assess the effectiveness of marine debris legislation and existing efforts to control marine debris. The U.S. EPA hired TOC, through a cooperative agreement, to develop a National Marine Debris Monitoring Program (NMDMP), a scientific marine debris monitoring program designed to assess the effectiveness of the current U.S. marine debris legislation.[68] After developing and testing a marine debris monitoring methodology to be used in the program, the TOC began the sampling for the NMDMP in 2002. The monitoring takes places at selected beach locations in coastal states throughout the country. Volunteers conduct beach cleanups (sample collection) and marine debris surveys at selected study sites every 28 days.

INTERNATIONAL COASTAL CLEANUP

The International Coastal Cleanup (ICC) is coordinated in the U.S. by TOC. This year is the 20th year that TOC has coordinated the national program in this global event. As of 2005, all 55 U.S. states and territories and 127 countries bordering every major water body in the world have participated in the ICC. In the past two decades, 5.8 million volunteers have collected more than 110.4 million pounds of debris along 158,657 miles of shoreline and underwater areas. The ICC includes a data collection component where volunteers use a data card for tracking the types, amounts, and sources of debris they collect. The data card is designed to provide a snapshot assessment of the types and amounts of debris found during ICC.[69]

THE U.S. COMMISSION ON OCEAN POLICY

Pursuant to the Oceans Act of 2000 (P.L. 106-256), President Clinton appointed 16 members from diverse backgrounds to the U.S. Commission on Ocean Policy. The Commission's mandate was to establish findings and develop recommendations for a new and comprehensive national ocean policy. The U.S. Commission on Ocean Policy released its report, "An Ocean Blueprint for the 21st Century," in September 2004. The report spurred additional national attention and programmatic interest in the marine debris issue.[70] The U.S. Commission on Ocean Policy recognized marine debris as a major threat to marine ecosystems and the health of U.S. coastal resources. Once the report was issued, the Commission was disbanded, as mandated by the Oceans Act of 2000.

After acknowledging that approximately 80% of marine debris in the ocean originates from land-based sources, the Commission report provided these recommendations to reduce marine debris:

[68] Sheavly p. 10

[69] Sheavly p. 4-17.

[70] http://www.oceancommission.gov//Documents/full_color_rpt/000_ocean_full_report.pdf

- NOAA should establish a marine debris management program that expands on and complements the U.S. EPA's program.
- NOAA and EPA should coordinate and implement expanded marine debris control measures.
- The National Ocean Council should re-establish the Interagency Marine Debris Committee (the authorization for the Committee lapsed in 1998).
- The Department of State and NOAA should coordinate and work with international organizations like the United Nations Food and Agriculture Organization and other international commissions to develop a plan of action to address derelict fishing gear around the world.
- NOAA should work with governmental and private entities to implement incentives to prevent, remove, and dispose of derelict fishing gear.
- The Department of State should increase international efforts to ensure implementation of Annex V of the International Convention for the Prevention of Pollution from Ships.

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

From 1985 to 1996, pursuant MARPOL, NOAA administered the marine Entanglement Research program. This centralized marine debris program was eliminated in 1996. In 2005, in response to the Ocean Commission report, Congress appropriated funds to re-establish a centralized marine debris capability within NOAA. The program seeks to bring greater attention and solutions to this environmental problem by: supporting research and monitoring activities to determine the impacts of persistent marine debris on humans, fish, and wildlife populations; supporting educational and outreach programs and sponsoring community beach cleanups; identifying and pursuing projects to remove, reduce, and prevent marine debris; working with partner agencies and organizations to support research and education; and using international law to regulate commercial and recreational boating activities to reduce marine debris.[71]

NONPOINT SOURCE POLLUTION CONTROL

Under Section 6217 of the Coastal Zone Act Reauthorization and Amendments (CZARA) of 1990, the U.S. EPA and NOAA were jointly charged with overseeing the implementation of the national program to reduce nonpoint source pollution. One of the major sources of nonpoint source pollution identified in that effort is polluted runoff from urban areas.

STORM WATER REGULATION

Under the U.S. EPA's December 1999 Phase II storm water regulations, communities with populations between 50,000 and 100,000, areas that have experienced high growth rates, and construction sites larger than 1 acre were required to control urban storm water discharges. The Phase II regulations were issued nearly ten years after the agency issued its Phase I regulations. The Phase I regulations required the control of pollutants in storm water discharges from larger communities with populations greater than 100,000, and from 11 categories of industrial activity, including construction sites disturbing more than five acres.

State Programs and Initiatives

Marine debris is addressed at the state level by programs that focus on various elements of the marine debris problem. These programs focus on storm water pollution control, recycling of solid waste, beach cleanups and public education. There is no single State agency that is charged with addressing litter and marine debris.

[71] http://marinedebris.noaa.gov/about/welcome.html

THE CALIFORNIA OCEAN PROGRAM

In response to the Report of the U.S. Commission on Ocean Policy, Governor Arnold Schwarzenegger recognized that oceans are in need of significant actions to protect their health and productivity. In response, he directed the Secretary for Resources and Secretary for Environmental Protection to develop a plan of action for ocean and coastal management in California. *The Ocean Action Plan, Protecting Our Ocean: California's Action Strategy*, sets forth as primary goals for ocean protection in California:

- Increase the abundance and diversity of aquatic life in California's ocean, bays, estuaries, and coastal wetlands;
- Make the water in those bodies cleaner;
- Provide a marine and estuarine environment that Californians can productively use and safely enjoy; and
- Support ocean-dependent economic activities.[72]

The Plan called for the California Legislature to enact legislation to support the actions set forth in the Plan. The Legislature enacted the California Ocean Protection Act (Section 35500, Public Resources Code) in 2004. The Act established the California Ocean Protection Council whose mandate is to coordinate and improve the protection and management of California's ocean and coastal resources and implement the Governor Arnold Schwarzenegger's "Ocean Action Plan," that was released in October 2004.[73]

The Council is tasked with the following responsibilities:

- Coordinate activities of ocean-related state agencies to improve the effectiveness of state efforts to protect ocean resources within existing fiscal limitations.
- Establish policies to coordinate the collection and sharing of scientific data related to coast and ocean resources between agencies.
- Identify and recommend to the Legislature changes in law.
- Identify and recommend to the Governor and Legislature changes in federal law and policy.

The Council is required to conduct a triennial review of the Action Plan to assess progress toward achieving the goals set forth in the Plan.

WATER QUALITY REGULATION

The framework for the regulation of trash and debris in urban runoff by the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCBs) includes:

- Basin Plans (one per region, nine regions)
- Total Maximum Daily Loads (TMDLs)
- Municipal Separate Storm Sewer System Permits (MS4)
- Industrial Storm Water Permits
- The California Ocean Plan
- Nonpoint Source Pollution Control

Basin Plans

Each RWQCB in California has developed a Basin Plan that sets forth the beneficial uses of the region's waters that must be protected and water quality objectives that must be met. For trash and debris, the L.A. Basin Plan provides that "(w)aters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses."

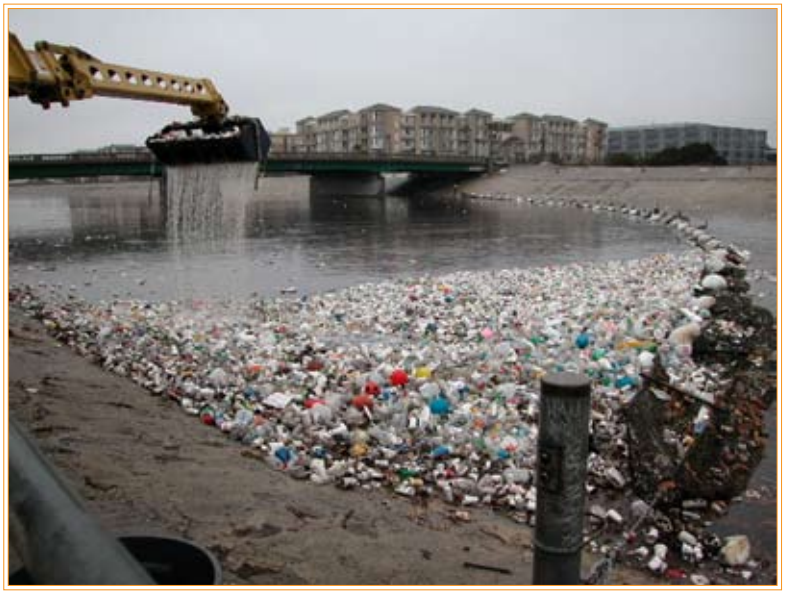
[72] *Protecting Our Ocean: California's Action Strategy*, September 2004, p. ii.

[73] Id.

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the State. Aquatic ecosystems and underground aquifers provide many different benefits to the people of the State. The beneficial uses described in a Basin Plan define the resources, services, and qualities of the aquatic system that are the ultimate goals of protecting and achieving high water quality. The Regional Board is charged with protecting all these uses from pollution and nuisance that may occur as a result of waste discharges in the region. Beneficial uses of surface waters, groundwater, marshes, and mudflats presented in a basin plan serve as a basis for establishing water quality objectives and discharge prohibitions to attain this goal.

Total Maximum Daily Loads (TMDLs)

Section 303(d) of the Clean Water Act (CWA) requires the State to identify a list of impaired water bodies and develop and implement TMDLs for these water bodies (33 U.S.C. 1313(d)(1)). A TMDL specifies the maximum amount of a pollutant that a water-body can receive and still meet applicable water quality objectives and protect beneficial uses. The CWA requires establishment of a TMDL when a water body does not meet water quality objectives. In 1998, U.S. EPA found that the L.A. River did not meet water quality standards due to trash. The U.S. EPA entered into a consent decree with the Natural Resources Defense Council, Heal the Bay, and the Santa Monica BayKeeper on March 22, 1999, under which the L.A. Regional Board was required to adopt a trash TMDL for the L.A. River within two years of that date. The Board adopted a trash TMDL for the L.A. River and Ballona Creek. On September 19, 2001, the Regional Board adopted amendments to the Basin Plan to incorporate TMDLs for trash in the L.A. River (Resolution No. 01-013) and Ballona Creek (Resolution No. 01-014). These TMDLs require regulated municipalities to implement a ten-year plan for reducing the amount of trash that is discharged to the Los Angeles River and Ballona Creek and establishes a final waste load allocation of zero trash discharge.[74]



Municipal Separate Storm Sewer System and Industrial Storm Water Permits

The State is charged with implementing the Porter Cologne Water Quality Control Act (California Water Code, Division 7, Water Quality) in order to protect the beneficial uses of the waters of the State. Through Porter-Cologne, the SWRCB implements the National Pollution Discharge Elimination System (NPDES) permit program of the Clean Water Act, Section 402. Under Porter-Cologne, the SWRCB, and the regional boards, regulate discharges of pollutants in storm water and urban runoff. The program involves regulation of discharges from: communities over 50,000, 11 categories of industrial activity, and construction sites greater than one acre.

Where there is a Basin Plan provision that prohibits discharges of floating materials and solids (such as plastic debris from industrial facilities) that adversely affect the beneficial uses of the water bodies of the region (as in the L.A. Basin Plan), no permits for discharge of these materials will be provided to municipal or industrial dischargers.

[74] http://www.waterboards.ca.gov/losangeles/html/meetings/tmdl/01_0125_LA_trash_fact_sheet.pdf

The California Ocean Plan

The California Ocean Plan is the State's water quality control plan for ocean waters. It lists beneficial uses of California's ocean waters that need to be protected; establishes water quality objectives necessary to achieve protection for those beneficial uses; identifies areas where discharges are prohibited; and sets forth a program of implementation (including waste discharge limitations, monitoring, and enforcement) to ensure that water quality objectives are met. The SWRCB adopted the Ocean Plan in 1972 and has since periodically revised the Plan. The physical characteristics of the ocean resources that the Plan is intended to protect include:

1. Floating particulates, grease, and oil shall not be visible.
2. The discharge of waste shall not cause aesthetically undesirable discoloration of the ocean surface.
3. Natural light shall not be significantly reduced at any point outside the initial dilution zone as the result of the discharge of waste.
4. The rate of deposition of inert solids and the characteristics of inert solids in ocean sediments shall not be changed such that benthic communities are degraded.

The Plan also provides that waste discharges shall not degrade water quality. Point sources of urban runoff discharges are a significant source of beach closure and impairment of beneficial uses in coastal waters of the State. Control of these discharges is under the jurisdiction of the SWRCB's storm water program. The Ocean Unit of the SWRCB was recently made part of the storm water program, suggesting that the Board feels that storm water regulation and ocean protection goals need to be coordinated. SWRCB staff has concluded that there is not sufficient information (on a state-wide basis) to determine whether existing storm water control programs are adequate to ensure compliance with Ocean Plan water quality standards.[75] The water quality objectives of the Ocean Plan do not specifically address plastic particulates or other trash.[76]

Nonpoint Source Pollution Control

Section 6217(g) of the Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) requires coastal states with approved coastal zone management programs to address nonpoint pollution impacting or threatening coastal water quality by developing a Coastal Nonpoint Pollution Control Protection Program (CNPCP). CZARA (16 U.S.C. ß 1451-1465) amends the Coastal Zone Management Act of 1972 to address five sources of nonpoint pollution: agriculture, silviculture, urban areas, marinas, and hydromodification. The urban category of the nonpoint source pollution program addresses pollutants in storm water and non-storm water from that are carried by urban runoff. These pollutants include "a wide array of materials, such as oil, sand, de-icing chemicals, litter, bacteria, nutrients, toxic materials and general debris from urban and suburban areas."[77]

[75] California Environmental Protection Agency, SWRCB, *California Ocean Plan: Triennial Review and Workplan*, November 16, 2005.

[76] *California Ocean Plan: Triennial Review and Workplan* at 43.

[77] SWRCB and CCC, *State of California Nonpoint Source Program-Five-Year Implementation Plan*, July 2003–June 2007, December 2003, Section IV, page 1

In September 2004, the SWRCB approved its *Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program* (NPS Policy). According to the NPS Policy, NPS control programs will be implemented through the issuance of Waste Discharge Requirements (WDRs), a waiver of WDRs for individual discharges or a category of NPS discharges, or prohibitions in orders or Basin Plan amendments that address nonpoint pollution sources. The SWRCB and CCC's Plan for California's Nonpoint Source Pollution Control Program identify pollutant source categories and applicable management measures.[78] The State is committed to implementing these management measures by 2013.

COASTAL PROTECTION

The CCC was established by voter initiative in 1972 (Proposition 20) and later made permanent by the Legislature through adoption of the California Coastal Act of 1976. The Commission, in partnership with coastal cities and counties, plans and regulates the use of land and water in the coastal zone. Development activities, which are broadly defined by the Coastal Act to include (among others) construction of buildings, divisions of land, and activities that change the intensity of use of land or public access to coastal waters, generally require a coastal permit from either the Coastal Commission or the local government.

Both the Commission's water quality and public education programs are engaged in preventing marine debris. Through its joint oversight with the SWRCB of the state's nonpoint source pollution program, the Commission is concerned with reducing litter and debris in polluted runoff. As the state-wide coordinating agency of the California Coastal Cleanup Day and many on-going beach cleanup activities throughout the year, the Commission's public education program helps to raise public awareness about the problem of marine debris. The Commission provides marine debris education and outreach to California school children by sponsoring teacher workshops, distributing its curriculum (*Save Our Seas* and *Waves, Wetlands, and Watersheds*), and by providing other educational resources and classroom presentations. The Commission supports local coastal education effort through its Whale Tale grants program.[79]

INTEGRATED WASTE MANAGEMENT AND SOLID WASTE

The California Integrated Waste Management Board (CIWMB) is charged with implementing a program of Integrated Waste Management that has at its core the goals of reducing, reusing, and recycling waste. The core efforts of the CIWMB have been focused on the mandate of the Integrated Waste Management Act, known as AB 939 (Chapter 1095, Statutes of 1989), which required municipalities to divert 25% of solid waste from landfills by 1995 and 50% by 2000. The CIWMB oversees local government efforts to achieve these diversion rates resulting largely through recycling. Other programs of the CIWMB that promote recycling and the use of recycled content, which may also promote waste collection and thereby reduce litter, include the Rigid Plastic Packaging Container (RPPC) law, the trash bag recycled content program, the film collection and recycling initiative, and the waste tire recycling program. The CIWMB has also developed extensive research and outreach materials on waste management issues in California.

BEVERAGE CONTAINER RECYCLING

The California Department of Conservation (DOC), pursuant to the California Beverage Container Recycling and Litter Reduction Act of 1986, amended 2005 (Public Resources Code, Division 12.1), reduces beverage container litter by providing a redemption value for most beverage containers sold in California. Known as the California Redemption Value (CRV), the refund awarded for recycling beverage containers is the reason that Californians recycled more than 12 million containers from the 20.2 billion carbonated and non-carbonated

[78] http://www.coastal.ca.gov/nps/npsndx.html#NPS

[79] For more information about the Commission's grants, water quality, and public education programs, visit www.coastal.ca.gov.

drinks they bought last year.[80] The Department distributes the funds collected from the CRV program to local government to support efforts to increase beverage container recycling.

LITTER ENFORCEMENT

On highways throughout the State, the California Highway Patrol (CHP) is responsible for the enforcement of litter laws. The CHP does issue tickets to vehicles that are not tarped, but relatively few tickets for littering are issued since the violation has to be observed in progress.[81]

BOATING EDUCATION AND REGULATORY PROGRAMS

The California Department of Boating and Waterways (DBW) and the California Department of Fish and Game (DFG) have programs that promote boating safety. DBW's programs include boater education about environmentally sound boating practices and boating safety courses. The DFG enforces the California Fish and Game Code through on-the-water enforcement provided by wardens. In addition, local sheriffs and police departments enforce the Harbors and Navigations Code to promote safety on California's waterways. While officers are exposed to littering issues in their training classes, the primary focus is safety.

STATE LITTER EDUCATION AND OUTREACH PROGRAMS

The SWRCB launched the "Erase the Waste" Campaign in August 2003. The program takes a community-oriented approach, encouraging residents to prevent litter and other storm water pollution by appealing to community pride in the neighborhood and concerns about public health. Although the program was implemented in the Los Angeles area primarily, the programs and materials are available for local replication and implementation state-wide. Some of the tools provided by the program to assist residents with getting started include Neighborhood Action Kits, outreach materials, after school and elementary school water curriculum, and general storm water information via their website: www.swrcb.ca.gov/erasethewaste. All materials are provided in English, Spanish, Chinese, Vietnamese, and Korean. Outreach materials consist of tip cards and posters that address multiple pollutants, or specific pollutants such as litter, pet waste, paint, and home and gardening chemicals.

The Don't Trash California program of the California Department of Transportation (DOT) is a 22-month, $6.5 million state-wide effort to reduce trash and other pollutants in highway storm drains. The goal of the campaign is to create a social mindset in California that does not tolerate polluting the freeways and highways. The Department has 12 districts that coordinate outreach within their regions. The program is in its early phases of implementation and anticipates the use of outreach to media, special events, partnerships, paid media, and community outreach to reduce littering. Each local district conducts coordination efforts with other governmental and non-governmental agencies.

[80] http://www.conservation.ca.gov/DOR/index.htm

[81] Orange County Storm water Program, Trash and Debris Task Force, "A Review of Current Trash pollution and Mitigation Efforts in Orange County: Final Report," (January 2006): 5.

Regional Programs and Initiatives

THE BAY STORM WATER MANAGEMENT AGENCIES ASSOCIATION

A consortium of San Francisco Bay Area municipal storm water programs implementing NPDES programs.

SACRAMENTO RIVER WATERSHED PROGRAM

A group of stakeholders in the watershed that work together to ensure that the current and future uses of the river area are sustained, restored, and enhanced while promoting long-term social and economic vitality of the region.

THE SANTA MONICA BAY RESTORATION COMMISSION

The Santa Monica Bay Restoration Commission was established to help guide the implementation of the 1995 Bay Restoration Plan. Key objectives include: implementing pollution prevention and habitat restoration projects, promoting cutting-edge research and technology, building a comprehensive regional monitoring program and funding programs to raise public awareness about Bay issues. Many of the programs implemented to meet the goals for the Bay Restoration Plan have involved the Commission in studying and promoting the control of pollutants, including trash and debris, in urban runoff.

OFFICE OF WATER PROGRAMS, CAL STATE UNIVERSITY, SACRAMENTO

Online courses based on the California Storm water Quality Association's Storm water Best Management Practice (BMP) Handbooks.

Local Government Programs and Initiatives

While State and Federal government regulation is often the catalyst for action, most efforts to reduce trash and debris in urban runoff are implemented at the local level. Many local agencies, especially in densely populated urban areas, have storm water pollution reduction programs that rely on a combination of structural and institutional controls to reduce trash and debris flowing through the storm drain system. Local governments are also opting for more targeted regulation of trash and marine debris by enacting bans and prohibitions on specific materials, and (more recently) taxes on litter-generating businesses. Local waste reduction and recycling efforts result from State requirements to achieve a 50% diversion of solid waste from landfills, as well as local initiatives targeting reduction of specific products that are litter prone. While they are numerous, the programs discussed in this section are no more than a sampling of local efforts to control trash, litter, and storm water pollution in California.

MUNICIPAL STORM WATER PROGRAMS

Many cities and counties hold NPDES permits for discharge of pollutants to state waters. In efforts to comply with these permits, local jurisdictions can either regulate or prohibit non-storm water discharges from local businesses. Many local storm water control programs are part of the California Stormwater Quality Management Association (CASQA).[82] Some local storm water programs operate under water quality ordi-

[82] CASQA's website lists the following programs, which include member and nonmember municipal stormwater programs in California: City and County of San Francisco Public Utilities Commission; City of Folsom; City of Monterey, Public Works Department, Storm water Management; City of Newport, "Clean Water Newport;" City of Roseville, Storm water Management; City of Sacramento, Storm Water Management Program; City of San Diego, Water Department; City of Santa Rosa, Public Works, Storm Water; City of St. Helena, Dept. of Public Works; City of Stockton, Municipal Utilities Dept., Storm water Management; City of Tracy, "Water Resources;" County of Contra Costa, Clean Water Program; County of Los Angeles, Department of Public Works, Watershed Protection; County of Marin, Storm water Pollution Prevention Program; County of San Diego, Watershed Protection; County of Santa Barbara, Public Works Department, Water Resources Division; Orange County Watershed & Coastal Resources Division; Project Clean Water, San Diego; Project Clean Water, Santa Barbara; Riverside County Flood Control and Water Conservation District; Sacramento County Storm water Quality Program; San Bernardino County, Storm Water Program; Santa Clara Valley Water District; Santa Clara Valley Urban Runoff Pollution Prevention Program; Ventura Countywide Storm water Quality Management Program

nances that allow them to inspect local businesses to determine whether Best Management Practices (BMPs) are adequately implemented to prevent pollutant discharge.[83]

Most of efforts to physically capture or prevent trash and debris from entering the storm drain system are initiated by jurisdictions that are required by the Los Angeles River or Ballona Creek trash TMDLs to reduce trash in urban runoff or in compliance with an MS4 permit. The structural methods employed by these jurisdictions include:

1. Storm water filtration devices;
2. Catch basin drain inlet devices;
3. Full-capture systems, including hydrodynamic separators
4. End of pipe pollution traps to remove pollutants from piped storm water inflows; and
5. Floating booms, nets, and traps[84]

Catching trash and debris before it enters the storm drain system is very effective in many areas. Municipalities and new private residential and commercial developments are installing various types of catch basin and storm drain inserts that rely on screens, filters, bags, trays, and diversion chambers to collect and divert trash and debris.

Drainage facility inspection and maintenance is another method that local storm water programs use to control trash in storm water.[85] Communities annually remove trash, debris and sediment from catch basins and channels as needed. Removal of material is typically performed manually, though on some occasions a vacuum truck is used to remove material from catch basins.[86]

Institution controls typically implemented by municipalities include:

1. Street sweeping
2. Increased frequency of garbage collection
3. Anti-litter education and outreach
4. Enforcement of local anti-litter laws

Most cities and counties have anti-litter ordinances that provide them with authority to take enforcement actions against individuals for littering. In Orange County, for example, all but two of the 35 cities have anti-litter ordinances. Enforcement generally consists of a fine.[87] Litter ordinances are difficult to enforce because the litterer must be observed in the act of littering by an enforcement officer.

LOCAL GOVERNMENT PRODUCT BANS, PROHIBITIONS, FEES AND TAXES

Prohibitions on Expanded Polystyrene Foam and Disposable Plastics

The City of Laguna Hills was the first to ban the use of expanded polystyrene foam at City-owned facilities on April 13, 2004. Similar bans on the use of expanded polystyrene foam have been established by five additional resolutions adopted by other cities/agencies within Orange County including: City of San Juan Capistrano, City of Laguna Woods, City of Huntington Beach, City of San Clemente, City of Laguna Beach, and Santa Margarita Water District.[88]

[83] Orange County Trash and Debris Task Force at 4-5.

[84] Id. at 10.

[85] Id.

[86] Id at 9.

[87] Id. at 5-6.

[88] Id at 3. Copies of the ordinances can be found in Appendix D of that report.

Outside Orange County, the City of Malibu has implemented an expanded polystyrene foam ban for all food vendors, restaurants, and city-operated facilities. The City of Berkeley has a prohibition on expanded polystyrene foam related to take-out food containers in food service establishments. The County of Ventura enacted a prohibition on expanded polystyrene foam by vendors, franchisees, lessees, contractors, and other commercial food and beverage purveyors at the County Harbor, Parks, and at the Government Center, as well as at special events held at county facilities that are sponsored or co-sponsored by the County.

Smoke-free Beaches

In October 2003, Solana Beach was the first California city to ban smoking at the beach. Since the Solana Beach effort, an additional 15 California cities have enacted or are considering bans on smoking at the beach.[89] The County of Los Angeles also passed a smoking ban on beaches within its jurisdiction. Cigarette butt litter on beaches originates both from beach-visitor littering and litter in urban runoff (from streets). Litter characterization studies conducted state-wide by the California DOT have found cigarette butts to be the number one littered item along highways.[90]

Litter Tax on Fast Food

In order to address the City's growing litter problem, the City of Oakland enacted the first tax on fast food restaurants and convenience stores in the nation. The tax ranges from $230 to $3,815 per year, depending on the size of the business, and targets businesses in areas around high schools and junior high schools, where most of the trash is generated. The City will use the estimated $237,000 a year it raises from the fees to hire crews to clean up the litter.

LOCAL WASTE RECYCLING AND REDUCTION EFFORTS

In order to accomplish the state-wide goal of 50% diversion of waste from landfills, local governments provide various levels of solid waste recycling, collecting different types of materials using differing methods from one jurisdiction to the next. Some counties have set high goals for diversion. Los Angeles County anticipates reaching a 75% diversion rate. The City of San Francisco established a zero waste ordinance, aiming for 100% diversion. Jurisdictions that use curbside collection generally achieve higher rates of recycling. Many urban areas face the challenge of collection from multi-unit dwellings, and large venues are increasingly becoming a focus for helping achieve higher recycling and diversion rates.

The first bag-to-bag recycling program in the nation was established by the City of San Juan Capistrano. The program is a cooperative effort between the City of San Juan Capistrano, the city's waste hauler (CR&R), and Hilex Poly Company, the largest carryout grocery bag manufacturer in the U.S. The City collects the bags, sells the material to Hilex, and Hilex recycles the bags back into new bags for retail customer purchase and public use. Bags that are collected in this program are re-used in the manufacture of new bags. Many communities see this "cradle to cradle" effort as a possible solution to bag litter.[91] The Progressive Bag Alliance, which initiated this program, is helping other cities and counties develop bag-to-bag programs. Other cities are developing "bag-in-bag" programs, which provide curbside collection for plastic bags but recycle the plastic in various markets such as lumber and carpets, thus it is not a closed loop type of recycling program.

In October 2005, the City of San Francisco entered into a cooperative agreement with the large grocery chains that serve most of the City's population to achieve a ten million-bag reduction within a year. This initiative was developed in response to the proposed $0.17 per bag fee that the City considered imposing on the use of plastic and paper grocery bags at checkout counters at the same grocery store chains.

---

[89] Id.

[90] www.donttrashcalifornia.info/pdf/Statistics.pdf

[91] The concept of "cradle to cradle" materials production was developed and described by William McDonough and Michael Braungart in *Cradle to Cradle: Remaking the Way We Make Things* North Point Press, 2002. The concept is similar to closed loop recycling. It eliminates waste (as in the traditional "cradle to grave" system of waste management) because waste products are used to remake the same type of product.

PLASTIC AND MARINE DEBRIS TASK FORCES

Several local government task forces have been created to study the issue of marine debris and focus actions to reduce it. These initiatives are similar in approach in that they involve local government, the private sector, and local environmental advocacy organizations.

City of Laguna Beach

In April 2004, the City of Laguna Beach, in partnership with the Laguna Beach Chamber of Commerce, the Ocean Laguna Foundation, and Waste Management, created a local program to reduce marine litter and polystyrene debris through education and trash removal.

Los Angeles River Plastics Industry Task Force

After determining that plastic litter, predominantly plastic bags, constitute the single greatest component of urban litter in the Los Angeles River, the Los Angeles City Council created the Los Angeles River Plastics Industry Task Force in February 2005. As a first step, the Task Force was charged with investigating viable solutions that prevent plastic, specifically plastic bags and expanded polystyrene foam, from polluting local waterways. The Final Report from the Task Force, issued on August 3, 2005, recommended:

- Supporting an "Adopt-a-River" Program to secure funding for cleanups, maintenance, education, and improvements in the River;
- Establishing a uniform City-wide public education message and anti-litter effort for plastic bags;
- Implementing a pilot anti-litter program in trash hot spot areas, in partnership with the City; and
- Fostering market development for recycled plastic bags.

Orange County Trash and Debris Task Force

In November 2004, the Orange County Storm water Program formed a Trash and Debris Task Force comprising a multi-stakeholder group. The Task Force was formed to develop and implement a regional coordinated strategy to eliminate litter and to prevent trash and debris from entering local waterways and the ocean.

San Diego County Trash and Debris Task Force

Recently, San Diego County agreed to create a task force using the Orange County model.

National Public Interest Groups

THE OCEAN CONSERVANCY

The Ocean Conservancy (TOC) has historically been the only national nonprofit organization with a significant marine debris program. The Conservancy has coordinated the ICC event nationally each year for the past 20 years. The Conservancy coordinates the National Marine Debris Monitoring Program under contract with the U.S. EPA.

SURFRIDER FOUNDATION

The Surfrider Foundation is a national nonprofit organization dedicated to the protection and enjoyment of the world's oceans, waves and beaches for all people, through conservation, activism, research and education. In terms of marine debris, chapters of Surfrider Foundation in California have been instrumental in assisting beach debris monitoring efforts.

California Public Interest Groups and Associations

ADOPT-A-BEACH PROGRAMS

Bringing volunteers to beaches and inland waterways was initially considered a public education strategy. Increasingly, however, local nonprofit organizations in urban watersheds throughout the State are adopting shorelines and beaches and cleaning more frequently, such that some programs are looking more like clean-up and abatement efforts than purely efforts to raise public awareness. The agencies and organizations implementing beach and shoreline cleanups are too numerous to name. No single agency has a catalogue of all of these efforts, although the CCC has a list of approximately 30 Adopt-A-Beach programs. The California Conservation Corps, Save Our Shores, Heal the Bay, I Love a Clean San Diego and Surfrider Foundation are among the groups providing the most frequent and wide-ranging cleanups.

ALGALITA MARINE RESEARCH FOUNDATION

AMRF is a Long Beach-based non-profit environmental organization dedicated to the preservation of the marine environment. With the help of its chartered research vessel, The Oceanographic Research Vessel (ORV) Alguita, AMRF is actively engaged in innovative research, education and restoration of the marine environment. AMRF has conducted extensive research documenting the extent, character and distribution of plastic debris in the Pacific Ocean, near coastal waters and beaches of Southern California, and inland waterways of the Los Angeles and San Gabriel River watersheds. In addition to research, Algalita engages in watershed education and protection, kelp reforestation, and provides research assistance for coastal protection in Hawaii and Mexico.

CALIFORNIANS AGAINST WASTE

Californians Against Waste (CAW) lobbied for passage of California's first-in-the-nation Bottle Bill that led to a 70% reduction in the number of beverage containers ending up in landfill. CAW led the fight for the current solid waste program (AB 939) that required municipalities to achieve a 50% diversion of solid waste from landfills by the year 2000. More recently, CAW championed a law that requires the recycling of obsolete computers and cell phones.

CALIFORNIA STORM WATER QUALITY ASSOCIATION

CASQA is an association of multiple interest groups; including government, science, industry, development, and construction organizations, all with the common goal of advancing the storm water quality profession.

EARTH RESOURCES FOUNDATION

The Earth Resources Foundation initiated "the Campaign Against the Plastic Plague" in 2004 to organize local initiatives to raise awareness about the health and environmental threats posed by plastic. In addition, the Foundation implements the "Hold Onto Your Butts" Program, a beach clean up program that consists of picking of trash with a specific focus on collection of discarded cigarette butts. The Foundation organizes beach cleanup activities, storm water education and beach monitoring activities for high school students, and cleanups of streets and parks. The Foundation also advocates for local government implementation of smoke-free beaches, expanded polystyrene foam bans, and plastic shopping bag bans.

KEEP CALIFORNIA BEAUTIFUL

Keep California Beautiful (KCB) is a nonprofit organization in California whose purpose is to promote litter reduction through public education regarding proper waste disposal. Through the Tony Hawk and Sonny Garcia "Don't Trash California" campaign, KCB has been reaching out to kids throughout California with posters and book covers promoting an anti-litter message. KCB also supports hundreds of cleanup and recycling efforts each year and participates in the Great American Cleanup. KCB's Network of Proud Communities encourages cities to make a commitment to initiate litter prevention strategies in their communities. KCB provides members with resources, help in mobilizing volunteers, and workshops to support their efforts in combating litter one city at a time. The Proud Communities Program has 100-plus members.

FRIENDS OF THE LOS ANGELES RIVER

Friends of the Los Angeles River (FoLAR) is a nonprofit organization founded in 1986 to protect and restore the natural and historic heritage of the Los Angeles River and its riparian habitat through inclusive planning, education and wise stewardship. One of FoLAR's longest running programs is La Gran Limpieza, the Great Los Angeles River Clean Up. In 2004, FoLAR's La Gran Limpieza became the largest urban river clean up the country and the largest multi-cultural, multi-ethnic volunteer effort in California.

HEAL THE BAY

Heal the Bay is a nonprofit organization founded in 1985 and dedicated to improving water quality in the Santa Monica Bay and surrounding waters through research, advocacy, education and community action. Heal the Bay sponsors regular volunteer-based beach and creek clean-ups throughout Los Angeles County, over 300 of which were conducted in 2005. In addition, Heal the Bay's watershed-based educational programs, including Speaker's Bureau, Adopt-A-Beach, Key to the Sea, and Santa Monica Pier Aquarium programs inform the local community about the causes and consequences of marine debris and other water quality issues.

Industry Initiatives

THE AMERICAN PLASTICS COUNCIL

In partnership with Society of the Plastics Industry (SPI), the American Plastics Council (APC) is promoting zero pellet loss at resin producing and processing facilities in California. APC took the lead on revising the Operation Clean Sweep (OCS) manual and has developed training materials posted on the website (www.opcleansweep.org) and stickers to support the program. In Orange County, the APC is supporting the efforts of KCB, the state's leading anti-litter organization, to distribute a comprehensive anti-litter tool kit for city officials throughout Orange County. The tool kit includes a ready to air television public service announcement to encourage citizens not to litter, information on grant programs and resources to conduct recycling, cleanup and other beautification projects.

THE CALIFORNIA FILM EXTRUDERS AND CONVERTERS ASSOCIATION

California Film Extruders and Converters Association (CFECA) has launched an Environmentally Preferred Rating (EPR) certification program. The EPR program consists of an independent environmental audit of a company's plastic manufacturing facilities focusing on the six areas that most potential impact on the environment: airborne emission, liquid emissions, pellet containment, recycling programs, post consumer resin use and community environmental activities. With respect to pellet containment, this program offers an independent certification program that will verify that companies are adopting OCS and are aware of the best management practices.

PROGRESSIVE BAG ALLIANCE

In recognition of the need to deal with plastic bags in the litter stream and the potential resources that can be used from recycled grocery bags, the four largest manufacturers of plastic grocery bags in the United States formed the Progressive Bag Alliance (PBA). The PBA is working with grocers in California to increase bag recycling and reduce the impacts of the bags on the environment. The PBA also works with local governments to add all types of plastic bags and film products to curbside recycling collection programs and to create anti-litter education programs for the public.

THE SOCIETY OF THE PLASTICS INDUSTRY

In recognition that mishandled pellets are carried by storm water and non-storm runoff into estuaries and other bodies of water, the SPI created and publicized to its members and processors nationwide the OCS program. In partnership with the APC, SPI is educating resin processors about the impacts of poorly handled resin pellets on the marine environment and informed of BMPs for achieving zero pellet loss. The BMPs included in Operation Clean Sweep for achieving zero pellet and powder loss target resin producers, processors, transporters and packagers of plastics.

PART IV

Actions to Reduce Marine Debris from Land-Based Sources

The recommendations in this section are grouped into categories of actions that address:

- The Need for Improved Coordination
- Research Needs
- Specific Sources of Land-based Discharges
- Product Wastes

The focus of this section is on specific sources of land-based discharges. These discharges occur as a result of behaviors or activities on land that cause litter or human-made debris to enter water bodies that lead to the ocean. The first section, coordination and research needs, identifies actions that are needed to close gaps in our understanding of the marine debris problem, as well as gaps in our approach to implementing solutions in California. The second section addresses the specific sources of land-based discharges and recommends actions that focus on the solving the problem source by source. The third section, solid waste generation, is on an indirect source of marine debris – the increasing quantity of product waste that is being generated and has the potential to become littered or otherwise discharged to the marine environment.

—1—
Actions to Address the Need for Improved Coordination

Recommendations for improved coordination emerged in the process of developing this Plan and are also based on the experience gained in the *Plastic Debris, Rivers to Sea Project*. Participants in the Marine Debris Work Group also considered these actions among the highest priority recommendations of this Plan.

ACTIONS RECOMMENDED

ACTION # 1:

Provide a mandate to control marine debris and litter to one or two State agencies and provide funding for both programs. The ability of the State to successfully decrease litter and marine debris is hampered by the lack of permanent well-funded programs in these areas. This program will require permanent funding and staff. The program can oversee implementation of the recommendations in this Plan. The program should provide a web-based clearinghouse of information about litter and marine debris and hold annual or bi-annual conferences to showcase successful strategies as well as the latest research. The program should share information about reducing waste generation, reducing litter, and controlling trash in urban runoff and storm water. It should assess needs for improving local, regional and State responses.

Potential Implementers: Legislature

ACTION #2:

Develop an Interagency Task Force on Marine Debris in order to assure adequate coordination and implementation of actions to reduce marine debris in California. The tasks of eliminating marine debris relate to the programs of several State agencies. These agencies should be included in the Task Force:

- California Coastal Commission
- California Department of Boating and Waterways
- California Department of Conservation
- California Department of Transportation
- California Integrated Waste Management Board
- California State Parks
- Ocean Protection Council
- San Francisco Bay Conservation and Development Commission
- State Coastal Conservancy
- State Water Resources Control Board

The Task Force should be initiated at the agency Director level and should have the authority to spend, manage, and implement funds to deal with marine debris. It should hold regular meetings for networking and information sharing. The Task Force should coordinate with existing state-wide initiatives to control litter.

Potential Implementers: Executive Office, Legislature, the agencies listed above

—2—
Actions to Address Research Needs

The recommendations developed for future research emerged as priorities at the *Plastic Debris, Rivers to Sea Conference*, September 7–9, 2005 and were seen as high priority actions by many of the participants in the Marine Debris Work Group.

ACTIONS RECOMMENDED

ACTION # 3

Conduct studies of trash in urban runoff in litter and marine debris "hot spots" throughout the State to characterize the most significant products contributing to the problem of marine debris from land-based sources. Actions targeting the reduction of trash and debris in urban runoff need to be based on a well-formulated understanding of the specific sources that need to be targeted within each geographic region. This research program should employ uniform standards, methods, and protocol for data collection among the regions so that accurate comparisons and prioritizations can be made. It should identify debris both in terms of material composition and specific products. Data should be collected regarding both weight and abundance. Trash and litter is likely to differ from one "hot spot" to the next, even if it originates from a similar type of land use.

Potential Implementers: California Sea Grant, the SCCWRP, AMRF, CCC, the volunteer monitoring network, the Coastkeeper Alliance, other nonprofit organizations and research institutions.

ACTION #4

Conduct research regarding potential bioaccumulation or other marine ecosystem impacts of plastic additives. Many chemicals, including toxic heavy metals, and organic chemicals, such as phthalates, nonylphenols, and Bisphenol-A are added to plastic resins to provide various characteristics. Researchers have also found that plastic debris absorbs and adsorbs from sweater at nearly one million times background levels.[92] Bioaccumulation of these plastic additives and other chemicals that adhere to plastic debris in fatty tissue or serum of organisms consuming contaminated micro plastics is a possibility. If bioaccumulation is not occurring, other potential harmful impacts may be occurring among benthic organisms. Additional research is necessary to determine whether any toxic substances migrate from plastics to the marine food chain and, if this is occurring, how it affects life at all levels of the marine food chain, from plankton to higher consumers. Since research has also shown that zooplankton and other organisms at the base of the marine food chain ingest micro-particles of plastic,[93] further research is needed to understand whether direct ingestion of plastic pellets, fragments, and micro-particles of plastics could be a direct route of plastic additives and sorbed chemicals to marine life.[94]

Potential Implementers: AMRF, California Sea Grant, SCCWRP, University of California, other research institutes in California and world-wide

[92] Mato, Y., et al. 2001.

[93] Thompson, et al.

[94] Takada H.

ACTION #5

Investigate the impacts on the marine ecosystem of micro-particles of plastics. Research has shown that micro-particles of plastics in the oceans are increasing.[95] This raises questions regarding their impacts on the marine ecosystem and also points to the need to focus additional research in this area. No government or industry programs for monitoring micro-plastics in the environment currently exist.

Potential Implementers: AMRF, California Sea Grant, SCCWRP, University of California, other research institutes in California and world-wide

ACTION # 6

Develop standardized research protocol and provide baseline documentation on quantity of plastic accumulation rates in deeper waters, including source identification and trend analysis. Over the last several decades, many plastic debris accumulation studies have been performed using vastly different data collection, measurement, and analysis techniques. This research needs to be conducted using standardized monitoring and assessment protocol in order to conduct trend analysis. Standardized methods lead to comparable and repeatable results. Developing standardization in monitoring and assessment protocol is important because it will:

1. Improve comparisons among sites and different periods at the same site, thereby enabling scientists to assess environmental improvement or further degradation. These assessments will be useful in measuring the effectiveness of actions implemented to reduce marine debris.
2. Improve sample designs and techniques, thereby saving resources and time and allowing for sound statistical analysis that may lead to better understanding of the sources of the contamination and act to cease them.

Therefore, the first priority in this research is to promote greater communication and cooperation among marine debris researchers and to encourage the development of standardized research methods.

Potential Implementers: U.S. EPA, NOAA, National Academy of Sciences, AMRF, California Sea Grant, SCCWRP, University of California, other research institutes in California and world-wide

ACTION #7

Determine the effects of rafting invasive species and ecological effects on benthic organisms. Some scientists believe that the migration of species by "rafting" on plastic debris poses one of the greatest threats to global biodiversity. Floating plastic debris more than doubles the rafting opportunities for biota, particularly at high latitudes. Many types of animal use marine debris as a mobile home, particularly bryozoans, barnacles, polycheate worms, hydroids and mollusks.[96] By investigating impacts of invasive rafting species on benthic organisms, researchers can begin to understand the impacts in the marine ecosystem.

Potential Implementers: AMRF, California Sea Grant, SCCWRP, University of California, other research institutes in California and world-wide

ACTION #8

Assess socio-economic impacts associated with littering and marine debris (i.e. impacts on tourism and fisheries). Investigations of potential economic impacts of marine debris related to tourism

95 Id.

96 Barnes, D.

and fisheries are needed to better assess the impacts of marine debris in California. The research should address the following questions:

- How much money are coastal California communities spending on cleaning trash and debris from beaches?
- How much is being spent in total by local jurisdictions on street sweeping, garbage collection, storm drain clean-outs, storm water pollution prevention, and river cleanups to prevent trash from polluting beaches and coastal waters?
- How much tourism money is lost by coastal communities as a result of trash and debris on beaches?
- What (if any) economic loss do coastal communities experience as a result of impacts of marine debris on fishing?

Potential Implementers: California Trade and Commerce Agency, CCC, SWRCB, OPC, the California Sea Grant, the University of California, other academic and research organizations, CASQA, CalTrans, CIWMB, NOAA, local jurisdictions

—3—
Actions to Address Specific Sources of Land-based Discharges

Land-based behaviors and/or activities that cause debris to be conveyed to the ocean include:

- Littering by the general public (pedestrians and motorists)
- Littering by beach visitors
- Littering by recreational boaters and commercial fishermen
- Commercial shipping (pleasure cruise ships and cargo ships in port)
- Garbage management (the transport and disposal of garbage)
- Plastics manufacturing and transportation facilities

Although boating and shipping are usually considered ocean-based issues, waste handling at ports and marinas is a land-based activity. Without proper waste handling systems for recreational boats, commercial fishing boats, and commercial ships, the threat of marine debris is higher. Since waste handling at ports and marinas is a land-based activity, this Plan includes these activities with the other land-based debris sources.

In this section, each of these activities or behaviors is addressed by (1) describing the activity or behavior and how it conveys litter or debris to water bodies, and (2) recommending actions for which there are potential implementers in California.

Combined sewage overflows (CSOs) are another source of litter and debris that are land-based. However, since debris and trash in urban runoff is the upstream source of trash that ends up in combined sewage and storm water treatment systems, and there are many actions addressing trash before it enters the sewage treatment system, this Plan does not recommend separate actions to address the discharges of CSOs.

Littering by the General Public

WHAT IS LITTER?

A standard definition of litter in water bodies has yet to be widely accepted. The California DOT has defined litter as "…manufactured materials that fail to pass through a screen with a 1/4-inch mesh." The materials covered by this definition include items such as cartons, cups, cans, napkins, and cigarette butts. The definition does not include materials of natural origin such as soil, gravel, and vegetative debris."[97]

WHO LITTERS AND WHY?

When pedestrians or motorists litter, they are exhibiting poor waste management behavior. Sometimes the lack of access to adequate waste disposal receptacles and services are to blame. However, some local governments with significant litter problems in California have concluded that they have provided adequate access to waste receptacles.[98] Since litter is often deposited on the ground near trash receptacles, access and convenience are not necessarily the only factors that determine whether or not pedestrians and motorists choose to properly dispose of waste. Often littering is the result of a lack of concern for the community and its surroundings.

Few studies exist that describe the attitudes or sociological factors that would explain why people litter. However, one study characterized why people don't litter and found that:

- People who feel the highest personal obligation not to litter are also people who feel a strong sense of identity with their communities, frequent recreational areas, have self-esteem, and place special value on a sense of accomplishment, warm relationships, and a sense of belonging.
- People who don't litter are not necessarily going to pick up other people's litter. While a good education seems to have a positive effect on people's individual littering and recycling habits, those with the highest levels of education are not as likely to pick up other people's litter.
- Littering appears to be less frequent in areas where community recycling is available. This correlation between littering and recycling may be attributed to public education associated with recycling which in turn has increased awareness of litter and a need to properly dispose of it.[99]

Most studies focus on the demographics of littering. For example, a 1997 study by the Los Angeles County Department of Public Works found that 9% of all of the County's population is responsible for 41% of all the litter dropped on the ground each month. This segment of the population is characterized as the "Rubbish Rebels," typically these are single males in their teens and early 20s, most with households of four or more members.[100] The Texas Department of Transportation reported similar results in its 1998 "Don't Mess with Texas litter attitudes and behaviors study." The findings of the study indicate that most litterers are teenagers or young adults under age 24.[101]

These studies did not attempt to answer the question of why people litter. They were more focused on assessing what messages motivate behavioral change among the various litter-prone segments of the population under investigation. However, the L.A. County study suggests that people who have a high propensity to litter lack connectedness to the local community and have a low level of awareness of litter impacts on the environment and public health.

---

[97] California Department of Transportation, 2000. "A Scientific Approach to Evaluating Storm water Best Management Practices for Litter" CSUS Office of Water Programs. www.owp.csus.edu/research/papers/papers/PP014.pdf

[98] http://www.sfgov.org/site/bdsupvrs_page.asp?id=4952

[99] http://www.arizonacleanandbeautiful.org/research.html cites research by Dr. Ingrid E. Schneider, Dept. of Recreation Management & Tourism, College of Public Programs – "Exploring Norms and Behaviors Related to Litter & Recycling Among Arizona Residents & Visitors."

[100] Pelegrin Institute; see also CalTrans, "Final Report. Public Education Research Study Literature Review," August 27, 2001, pp. 1-2, 1-3.

[101] Texas Department of Transportation. "Don't Mess with Texas litter attitudes and behaviors study," (1998) http://www.dontmesswithtexas.org/rfs1998.htm

COMPOSITION OF LITTER

Information regarding litter composition, in terms of materials, is fairly well documented. For example, a recent effort in California to characterize litter was conducted for the California DOT, also known as Caltrans. In the CalTrans Litter Management Pilot Study, the litter collected was separated into eleven composition-based categories:

- Paper
- Cardboard/chipboard
- Moldable plastic
- Plastic film
- Expanded polystyrene foam
- Wood debris
- Metal
- Glass
- Cloth
- Cigarette butts
- Other

Each piece of litter was also categorized by its probable original use – "food-related," "smoking related," and "other." Each litter category was quantified by air-dried weight, volume, and count.[102] The research concluded that the predominantly littered item is cigarette butts, followed by candy wrappers and other plastic and paper.[103] However, since the litter collected from catch basins along highways on which debris deflection equipment had been installed, most of the debris collected inside the catch basins for analysis was too small to be categorized into product categories. For the most-part, the data analyzed the material composition of the debris.

More valuable is the type of research that was performed for Mississippi by Dan Syrek of the Institute for Applied Research. A baseline survey of litter in Mississippi revealed that the products represented in Mississippi's roadside litter were:

- 26.6% Take-out food packaging, cups, napkins, etc.
- 17.3% Beverage containers, caps, tabs, cartons
- 9.8% Miscellaneous plastic, metal, foil, glass
- 9.4% Candy, gum, snacks
- 9.1% Miscellaneous paper, cartons
- 7.4% Vehicle parts, supplies, debris
- 6.7% Newspapers, advertisements, food packaging, yard trimmings, other
- 5.7% Cigarette packs, matchbooks
- 5.4% Building materials, construction debris
- 2.6% Toiletries, toys, cassettes, recreation[104]

This data, if available in California, would provide a clear indication of the types of products that are littering highways, roads, and, very likely, nearby water bodies.

CONVEYANCE OF LITTER TO WATERWAYS

In some areas, such as the San Francisco Bay-Delta and the San Gabriel River and Los Angeles River watersheds, trash from inland areas impacts the coast. For example, trash from the Central Valley can be

[102] CSUS Office of Water Programs, "Results of the Cal Trans Litter Management Pilot Study," (2001), http://www.owp.csus.edu/research/papers/papers/PP020.pdf

[103] CalTrans Storm water Program, CalTrans Public Education Research Study- Final Report, June 2003, p.14.

[104] Daniel Syrek, Frank Bernheisel, *Mississippi Litter 2000, A Baseline Survey of Litter at 113 Street and Highway Locations*, 2000.

conveyed from the Delta through the San Francisco Bay and out to the Pacific Ocean, littering beaches and shorelines along the way.

Each month in Los Angeles County, litter is dropped on the ground or out a car window 830,000 times, paper or trash is blown into the street more than 800,000 times, and trash is thrown into a gutter or storm drain nearly 280,000 times.[105] Litter that isn't collected by street sweepers, pedestrian recyclers and street cleaners, or storm drain system trash abatement systems often ends up in a nearby water body.

Varying levels of trash are associated with different types of land-uses. Commercial and industrial land uses have been shown to have higher litter rates than residential areas. For example, trash baseline monitoring for the Los Angeles River and Ballona Creek watersheds demonstrated that the greatest litter production occurs in industrial land use areas in the Los Angeles River watershed, while commercial land uses produced the most litter in the Ballona Creek watershed.[106]

EFFECTIVE LITTER CONTROL PROGRAMS

The most effective litter control programs prevent, rather than remove, litter. Most comprehensive control programs operate state-wide and typically employ a variety of components including: voluntary cleanups, elementary school education, enhanced litter law enforcement, litter hotlines, beautification projects, and media events. Such programs can be very effective. For example, Hawaii's litter reduction effort resulted in a 74% reduction of litter. Washington's anti-litter campaign resulted in a 76% reduction. Beverage container litter was reduced by 90% in both states.

In order to achieve ongoing litter reduction, litter control programs must be implemented continuously. In the state of Washington, for example, the litter program achieved a 76% reduction. Funding for the program was reduced and redirected toward recycling. Subsequently, population and traffic growth occurred and, within seven years, the litter rate climbed back up again, wiping out a third of the litter rate reduction that had been achieved. A renewed, aggressive campaign in 2002 achieved a 24.4% litter reduction within two years.[107]

ACTIONS RECOMMENDED

The actions recommended in this section include:

- Physical control and removal of litter
- Education to prevent littering
- Enforcement of existing laws to control litter
- Some of the actions recommended combine one or more types of actions, such as education and enforcement, to create a comprehensive strategy for addressing a particular problem.

ACTION #9

Provide adequate receptacles and collection of trash. Adequate receptacles are needed on residential streets, in commercial areas, at public venues, in parks, for apartment buildings, and for offices. Trash bins should be covered and animal-proof. Collection should be frequent enough to prevent overflow. Non-residential areas, including recreational areas, bus stops, special events, and large venues, as well as apartment buildings, should receive adequate service.

[105] L.A. Segmentation Study.

[106] County of Los Angeles DPW, February 2004, "Trash Baseline Monitoring Results for Los Angeles River and Ballona Creek Watersheds," http://ladpw.org/wmd/TrashBaseline/Trash%20Monitoring%20rpt.pdf

[107] Gershman, Harvey, "Apples and Oranges," *Municipal Solid Waste Management*, (November/December 2005). http://www.mswmanagement.com/mw_0511_guest_editor.html

Potential Implementers: Local jurisdictions, CSP, private businesses. Neighborhood improvement committees made up of businesses and citizens.

ACTION #10

Provide adequate receptacles and collection of recyclable materials. Recycling has been shown to prevent plastics, aluminum, and glass from becoming litter. Recycling should be increased. Recycling containers should be provided everywhere that trash collection is provided. Increase recycling curbside, at large venues, office and apartment buildings, and in highly litter-prone areas.

Potential Implementers: Local jurisdictions, CSP, private businesses, DOC, nonprofit organizations

ACTION #11

Reduce smoking-related debris by: (1) increasing enforcement against smoking litter; (2) providing adequate receptacles for cigarette butts; and (3) implementing a state-wide smoking litter outreach campaign. Since smoking-related litter is the most common debris found on beaches during cleanup events, an effective anti-smoking litter campaign needs to be implemented state-wide. Such a campaign can include public education, state-wide implementation of "smoke-free" beaches and increased anti-litter enforcement. The San Diego County reporting hotline (800-NO-SMOKE) can provide a model for enforcement. The County records calls to the hotline and forwards them to the California Highway Patrol (CHP), who sends warning letters to vehicle owners.[108] In terms of public education, tools from the SWRCB's "Erase the Waste" campaign, which focused in part on cigarette butt pollution, should be considered, and are available for use in California.

Adequate cigarette receptacles should be available in front of restaurants, bars, public venues, office buildings, and throughout commercial areas where smoking is permitted. State and/or local government governments should require ash tray/butt receptacles in outdoor areas where smokers congregate. Anti-smoking campaigns should include information about the impacts of smoking litter on the marine environment.

Potential Implementers: CHP, DOT, CIWMB, CCC, SWRCB, local enforcement authorities, local jurisdictions, commercial establishments, nonprofit organizations, the cigarette manufacturing and distribution industries, KCB, nonprofit organizations

ACTION #12

Conduct preliminary research in order to develop a state-wide anti-litter and marine debris campaign. Research is needed to identify (1) the demographics of where litter is coming from (i.e., litter and marine debris "hotspots" state-wide), (2) what segment of the population is most prone to littering, (3) why people litter, and (4) what messages are likely to promote behavior change. Although some research has already been conducted regarding litter behavior in California and elsewhere (see discussion above), additional research is necessary to develop a state-wide public education campaign.

Potential Implementers: NOAA, DOT, CIWMB, CSP, CCC, SWRCB, local jurisdictions, KCB, the plastics and take out food industries

[108] http://www.signonsandiego.com/uniontrib/20051003/news_1m3smoke.html

ACTION #13

Implement a coordinated and continuous state-wide anti-litter campaign for the general public. Although there have been a few recent efforts to provide litter education in high priority regions, a large-scale state-wide litter campaign is needed. The program should use a regional approach, customized to local communities. It should target litter "hot spots" (identified per Action #4 and #13) in inland and coastal regions first. The campaign should be based on sound research at the outset to help focus on significant litter-prone segments of the local community, as well as the most effective means of effecting behavior change in each region.

The campaign needs to be continuous and long-term in order to effect significant change in attitudes and behaviors. Television and radio advertising should be included because they reach large numbers of people and can be very effective. A multi-media communications effort, featuring electronic advertising, community outreach, youth, adult and industry education should be considered. Such a varied approach has been shown to be the most effective at creating a sustainable pollution prevention effort. Since pedestrian littering behaviors and motorist litter patterns are different, the campaign should address these separately.

A coordinated state-wide campaign and should, where possible, utilize existing education and outreach tools and avoid "reinventing the wheel." In many cases, local outreach may be adequate and should simply be coordinated with the overall state outreach effort.

Potential Implementers: DOT, CIWMB, SWRCB, CCC, NOAA, CSP, local jurisdictions, KCB, the plastics and take out food industries

ACTION # 14

Implement local anti-litter / anti-marine debris education efforts in conjunction with programs aimed at building community pride. Since a lack of connectedness to the community is one reason that some people litter, education programs should be directly coordinated with local community development programs. This initiative can be part of the state-wide anti-litter outreach campaign, but it needs to provide models that can be implemented at the local level. Alternatively, this approach can be promoted at the local level, without assistance from a state-wide campaign. A good model is the SWRCB's "Erase the Waste" campaign, which directly tied pollution prevention to public health and community pride. Tools from this campaign are now available for use statewide.

Potential Implementers: SWRCB, local jurisdictions, KCB, other nonprofit organizations, the plastics and take out food industries

ACTION # 15

Conduct research to determine whether messages regarding the costs of cleaning litter and trash are effective in motivating behavioral changes. Building on research conducted per Action #8 (i.e., determining the costs to local communities of cleaning litter and potential costs from losses of tourism), additional research should be conducted to determine whether information about costs is likely to motivate behavior change in litter-prone areas. The information provided to the public about costs of litter control should be accompanied by ideas for how the monies saved can be used to make improvements within the local community.

Potential Implementers: California Trade and Commerce Agency, CASQA, DOT, CIWMB, SWRCB, CCC, NOAA, local jurisdictions

ACTION # 16

Address littering caused by uncovered truckloads and illegal dumping. Highway litter includes intentional littering by motor vehicle operators, intentional dumping, and uncovered trash and debris that gets released during transport. Education and enforcement measures should be implemented to address these problems. Video cameras should be set up at locations of frequent littering and high truck traffic to catch illegal dumping violations. New techniques for preventing dumping and uncovered truckloads should be developed.

Potential Implementers: SWRCB, CHP, DOT, CIWMB, local jurisdictions

ACTION # 17

Expand the reach and duration of watershed-based work/study education programs that connect school children to their community and to the environment. Clean and Green in Los Angeles, administered by the Los Angeles Conservation Corps, is an example of such a program. It creates work opportunities for groups of inner city middle and high school children that are out of school for their mid-year break. This is most likely the first work experience the children have. The opportunities involve, among other things, cleaning up and renovating different areas of the city. The children are exposed to the local trash problem and learn about impacts on the marine environment. The SWRCB's water quality service learning program, an elementary school water curriculum, ties water education with community involvement. It was designed to support local NPDES permit requirements.

Potential Implementers: SWRCB, the California Conservation Corps, local jurisdictions, KCB, the plastics and take out food industries, nonprofit organizations (examples, Surfrider, SEA Lab, AMRF, the Ocean Institute)

ACTION #18

Increase litter and marine debris education in schools (K-12). Instilling a sense of stewardship of California's natural resources and coastal environments in young children, including awareness about the need to prevent litter, is essential to creating a long-term and cost-effective solution to these problems in California. The California Environmental Protection Agency (CalEPA) and CIWMB are charged with implementation of the Education and the Environment Initiative pursuant to AB 1548, enacted in October of 2003. CalEPA, the Resources Agency, Office of the Secretary for Education, State Board of Education and the Department of Education have collaborated to develop environmental principles and concepts and the model curriculum planning process is underway. The model curriculum will provide K-12th grade teachers, schools, and districts with standards-based curricular materials, approved by the State Board of Education, which can be used to teach California's environmental principles and concepts.[109]

An assessment should be conducted to determine whether the Education and the Environment Initiative and other efforts adequately address litter prevention. If not, the State should implement-a coordinated outreach program for schools on trash literacy and marine debris. Storm drain system education needs to be included in the marine debris and trash literacy program, as well as facts about the costs of litter to residents, communities and neighborhoods. The CCC curricula, "Save Our Seas," and "Waves, Wetlands, and Watersheds" and the CIWMB's waste reduction curricula are tools that can be used in this effort. This effort should consider the SWRCB's water quality service learning program, which teaches elementary students about storm water pollution prevention and watershed stewardship through service learning opportunities.

Potential Implementers: CalEPA, CIWMB, CCC, and SWRCB

[109] http://www.calepa.ca.gov/Education/Principles/Default.htm

ACTION #19

Increase anti-litter enforcement by local authorities and the CHP, and by citizen reporting using a new litter reporting hotline. Most municipalities in California have anti-litter ordinances. However, many jurisdictions lack the resources for adequate enforcement. Another challenge is the difficulty of catching litterers violating the law. Litter code enforcement should be increased with additional funding and /or creative new strategies. Strategies for increasing enforcement might include:

- Authorizing citizen monitoring
- Implementing a uniform reporting procedure and a reporting hotline
- Deputizing citizens in local communities as "trash police"

An anonymous litter reporting hotline would provide concerned citizens with a safe means to take action and help the enforcement officials with a problem that cannot be easily addressed without the help of extra eyes. The San Diego cigarette litter reporting system provides a good model.[110]

Potential Implementers: Local enforcement agencies, the CHP.

ACTION # 20

Provide and maintain cigarette litter receptacles wherever patrons or employees congregate to smoke. A commercial establishment that regularly has customers or members of the public congregating on or near its premises and finds cigarette litter is a continuous problem should provide cigarette litter receptacles.

Potential Implementers: Cigarette manufacturers, commercial establishments, the Legislature

ACTION #21

Ensure that municipalities prevent trash from entering the storm drain system. Most municipalities are required to prevent trash from entering the storm drain system under an NPDES permit. Many cities have already implemented BMPs to prevent trash from entering the storm drain system. The Regional Boards should ensure that municipalities are meeting this requirement. The State should identify areas where trash in urban runoff and in local waterways is significant (i.e. identify "hot spots" as suggested in Action #4 and 13). The State should focus on trash in urban runoff "hot spots" for compliance and should consider implementing more stringent controls, such as trash TMDLs, where necessary to achieve reductions in marine debris from land-based sources. The Regional Boards should assess whether litter is mentioned in the water quality objectives of their Basin Plans. If not, the Plan(s) should be amended to include litter in the water quality objectives.

Potential Implementers: State and regional water boards, local storm water management and pollution control agencies

ACTION #22

Coordinate and regularize watershed-based cleanups. Having regular clean ups in trash prone areas (beaches, creeks, rivers, wetlands) promotes environmental stewardship. Many local watershed cleanup programs already exist. The efforts are generated by local watershed protection organizations, in most cases. Once research on trash "hot spots" is conducted (per action #4 and #13), volunteer cleanup programs should be coordinated to ensure that all hot spots are covered. This state-wide watershed cleanup program could be modeled on the Cal Trans "Adopt a Highway" program. Adopt a Beach, Adopt-a-Creek,

[110] http://www.signonsandiego.com/uniontrib/20051003/news_1m3smoke.html

Adopt-a-River, and Adopt-a-Watershed programs should encourage year-round stewardship for coastal areas and inland areas that connect to coastal areas.

Potential Implementers: CCC, local watershed councils and networks, nonprofit organizations

Littering by Beach Visitors

Trash on beaches is not simply a result of litter left by beach visitors. It is also originates from ocean dumping and trash conveyed to beaches by inland waterways. In addition, litter from urban streets is conveyed by storm drain systems to combined sewage and storm water treatment systems that overflow to coastal waters during storm events. Actions recommended to prevent litter from migrating from inland areas to beaches are addressed in the previous section. The recommendations of this section focus mainly on littering by beach visitors and to a limited degree ocean-based marine litter that becomes stranded on beaches.

California's coast and beaches are among the State's most significant economic resources. Ocean and coastal tourism contributed $12 billion to the State's economy in 2000, making tourism the largest component of the seven ocean-dependent industries in the State.[111] California's beaches were the direct source of 273,000 jobs in 1998, and the indirect source of 883,000 jobs. They generated $63 billion in spending overall.[112] During the summer of 2000 in Los Angeles and Orange Counties, consumers spent almost $3 billion on beach-related activities. Beach visitors to Los Angeles and Orange County beaches support an estimated 58,600 full and part-time jobs annually.[113]

Severely littered beaches can cause coastal communities to lose millions of dollars in annual tourism revenue, and to experience declines in property values. For example, coastal communities in New Jersey lost two billion dollars in tourist revenue during the summer seasons of 1987 and 1988 due to beach closings when tons of debris from a landfill washed ashore. Those coastal communities in New Jersey now spend $1.5 million each year to remove debris from beaches and coastal waters to prevent another similar loss.[114]

ACTIONS RECOMMENDED

ACTION # 23

Increase the availability of trash and recycling receptacles and services at beaches state-wide. Entities that are charged with beach maintenance and oversee garbage collection at beaches (municipalities, CSP, and the National Park Service, etc.) should assess the adequacy of their trash and recycling collection services at local beaches. Where necessary, these entities should increase the availability of trash and recycling collection services. Trash receptacles should be covered both to prevent spillage and to prevent seagulls from removing debris.

Potential Implementers: local jurisdictions, CSP, and the National Park Service

ACTION #24

Implement a state-wide beach visitor education campaign about litter and marine debris. There is a need for a well coordinated and consistent multi-media outreach campaign for beach visitors about littering and its effects on the environment and the economy. The campaign should include literature at

[111] National Ocean Economy Program, *California's Ocean Economy*

[112] P. King, "The Fiscal Impact of Beaches in California," Public Research Institute for the California Department of Boating and Waterways (September 1999)

[113] Hanemann, W. Michael, Linwood Pendleton, and David Layton, 2001. *Summary Report on Expenditure Module, the Southern California Beach Valuation Project*, Dec. 16, 2001. Report can be obtained at: htttp://marineeconomics.noaa.gov/SCBeach/4Summary_Expenditures.pdf

[114] NOAA, August 1999. *Trends in U.S. Coastal Regions, 1970–1998: Addendum to the Proceedings*, "Trends and Future Challenges for U.S. National Ocean and Coastal Policy" http://www.oceanservice.noaa.gov/websites/retiredsites/natdia_pdf/trends_addendum.pdf

kiosks, inserts into park passes, signage at parks and beaches, video programming at park visitor centers, special presentations, cleanup activities, and distribution of free trash containers and other materials related to keeping beaches clean.

Potential Implementers: local jurisdictions, CCC, CSP, SWRCB and the National Park Service

ACTION #25

Increase enforcement of anti-littering laws at beaches. Enforcement officers should patrol beaches and issue citations or warnings for littering. Enforcement personnel can also assist in the distribution of anti-littering educational materials.

Potential Implementers: Local enforcement agencies, CSP

Littering by Recreational Boaters and Commercial Fishermen

In 1988, the Center for Marine Conservation (now TOC) estimated the amount of domestic waste generated by U.S. boaters to be 51,000 metric tons per year of trash. According to the U.S. Coast Guard, recreational fishing and boating account for approximately 52% of all rubbish dumped in U.S. waters.[115] Researchers working in support of the Coast Guard MARPOL Annex V regulations estimated recreational waste generation at 636,055 metric tons. The Coast Guard also estimated that two-thirds of recreational boaters bring waste ashore, based on conversations with marina operators who noted the frequent tendency of boaters to seek out marina and dockside dumpster facilities.[116]

The composition of vessel waste includes light sticks, food packaging, cups, bait containers, boat cleaning and maintenance product containers, fishing line, and nets. In addition to the general harmful effects of marine debris discussed in section 1, vessel waste poses additional potential harm, such as:

- Fouling of boat propellers and cooling intakes, causing economic loss and damage to vessels.
- "Ghost nets"– drifting fishing gear that entangles many marine creatures while circulating the open ocean.
- Trash and debris from food items can be mistaken for food by aquatic creatures and be eaten, leading to suffocation or starvation.

Approximately ten% of California's recreational boaters berth their boats in a marina. The vast majority of California boat owners (approximately 85%) trailer their boats and access waterways at boat launch ramps. The California Department of Boating and Waterways (DBW) funds approximately 80% of boat launch ramps in the State through grants and loans. The funding is predicated upon providing adequate waste receptacles. Marinas and boat launch ramps vary in ownership. Some are publicly funded and operated and many are privately owned and operated. These characteristics of the boating community need to be taken into account in addressing boat discharges.

The discharge of trash and debris from recreational and commercial vessels is included in this discussion as part of the overall problem of land-based discharges because discharges occur while boats are berthed in a marina or while using a boat launch ramp. Items are discarded or blown overboard as a result of failure to properly stow trash and bring it to marina disposal areas or as the result of a lack of adequate collection facilities at boat launch ramps. Furthermore, most of the solutions are land-based. Solutions focus on educating boaters not to litter and providing adequate receptacles and services to support clean boating

[115] UNESCO, *Marine Debris: Solid Waste Management Action Plan for the Wider Caribbean.* IOC Technical Series 41 (1994)

[116] EPA, *Methods to Manage and Control Plastic Waste, Report to Congress* (February 1990) Office Of Solid Waste and Office of Water EPA/530-SW-89-051 p. 3-28

habits. Particular segments of the boating community that generally receive little or no information about clean boating, such as boat renters and owners of boats that are trailered, require the most education and outreach.

Programs are already in place in California to address other wastes generated by recreational boating, including oil, sewage, and hazardous waste.[117] In the following actions, the term "waste" refers to trash and recyclable solid wastes, such as bottles, cans, and paper.

ACTIONS RECOMMENDED

ACTION # 26

Implement a program to assure that solid waste disposal and recycling opportunities are adequate for California boating. This action involves implementation of a needs assessment for solid waste disposal services for California boaters. The assessment must:

- Investigate and characterize the solid waste discharges for various types of vessels
- Examine the adequacy of solid waste disposal services for vessels in California
- Assess options for improving waste collection onshore and onboard

Once the needs assessment is complete, marinas, parks, and launch ramp operators must be encouraged to install adequate disposal and solid waste recycling facilities.

Potential Implementers: DBW, CIWMB, local government, boating and marina associations, clean marina certification programs, clean boating programs

ACTION #27

Improve waste management by vessel operators in marinas and harbors. Marina and port operators can accomplish this by:

- Allowing only commercial vessels with adequate onboard trash receptacles to berth in their facilities;
- Providing adequate trash collection and recycling services at marinas and ports, including (where needed) fishing line recycling services and facilities for recycling and disposal of large nets and solid waste;
- Having vessel waste-handling provisions in slip rental contracts and adequately enforcing them;
- Encouraging boaters to remove and recycle packaging before leaving the slip.

Clean marina certification programs should include inspections of commercial vessel solid waste management practices. Local government solid waste management programs should engage ports and marinas in solid waste diversion efforts. Marinas can encourage peer enforcement programs among slip renters. Mariners can be encouraged to report violations by calling the port, marina management, harbor patrol, or 1(800)OILS 911. Funding can be included in the rate structure for marina slip fees.

Potential Implementers: DBW, marina and boating associations, clean marina certification programs

[117] For information about managing other types of wastes associated with boating, visit the Commission's Boating Clean and Green Campaign website at: http://www.coastal.ca.gov/ccbn/ccbndx.html

ACTION #28

Target boat rental facilities, boat launch ramps, and heavy usage areas (restrooms and parking lots) to improve solid waste management by recreational boaters and fisherman. Vacationers that rent boats tend to be less informed about safe and environmentally sound boating practices. They need to be informed about safe and clean boating habits. Roughly 80% of California's one million registered boats access the waterways through boat launch ramps. Targeting boat launch ramps should be a high priority for encouraging California boaters to properly manage waste. Strategies include:

- Focusing education and outreach at boat launch ramps and boat rental facilities. Effective outreach efforts can include signage and DOCKWALKERS[118] to educate mariners about marine debris (packaging, fishing line, cigarette butts) and its impact;
- Providing adequate, accessible, and covered trash and recycling (solid waste and fishing line recycling) facilities and services at boat rental facilities and launch ramps; and
- Establishing an inspection program to determine whether boat launch ramps, marinas, and boat rental facilities have adequate waste collection services and maintenance of the services.

Since DBW funds improvements to and construction of boat launch ramps, signage and waste management facilities should be a condition for funding. Funding is available from the DBW in the form of grants and loans.

Potential Implementers: DBW for education and outreach. Facility operators should implement trash collection and recycling. Inspections to be implemented by local environmental health or waste management authorities or DFG wardens. DBW for adding waste management requirements to boat launch ramp funding.

ACTION # 29

Work with the National Association of State Boating Law Administrators (NASBLA) to incorporate environmental standards, including marine debris minimization, into boating curriculum. NASBLA developed its boating education courses more than a decade ago. These standards have served as a guide for state, nonprofit and commercial providers to follow in developing boating education materials. NASBLA currently has human waste standards and has information on aquatic invasive weed species. Methods for preventing the discharge of trash and debris from boats should be included in the curriculum.

Potential Implementers: DBW, NASBLA

ACTION #30

Include marine debris in boater education efforts. California's clean boating efforts, which currently include several local and regional clean boating education initiatives and marina certification programs, Dockwalkers, the Boating Clean and Green Campaign (CCC and DBW), the general educational efforts of DBW and the Coast Guard Auxiliary, and the United States Power Squadron should include marine debris in their outreach efforts. Through education and signage, boaters should be encouraged to use non-disposable products rather than plastic and expanded polystyrene foam cups and other disposable products that can get blown or tossed overboard.

Potential Implementers: DBW, CCC, local clean boating programs, marina certification programs

[118] DOCKWALKERS are volunteers trained to provide boaters with advice and materials to support environmentally sound boating habits. Since 1998, the CCC has been training volunteer boaters as DOCKWALKERS. To learn more, go to: http://www.coastal.ca.gov/ccbn/DOCKWALKERS.html#DOCKWALKERS.

ACTION # 31

Clean all boating and fishing-related trash from marinas, boat launch ramps, camping areas, and popular fishing areas. Most marinas maintain regular grounds maintenance schedules that direct staff to remove debris from grounds and docks. However, littering by boaters and fishers is often associated with non-marina boaters and fishers, such as, bank fisherman and "boat-in" campers. Boater education and outreach efforts should target these hard-to-reach groups.

Potential Implementers: Campgrounds, boat rental companies, marinas, CSP, local jurisdictions' parks departments, public works departments and sanitary agencies

ACTION #32

Encourage enforcement of anti-litter laws at boating venues. Marine enforcement personnel should be apprised of their authority to enforce local litter laws. They need to be informed about what to look for and how to report a problem.

Potential Implementers: California Boating Safety Officers Association, DBW, CCC, local clean boating education and enforcement programs

ACTION # 33

Implement shrink-wrap recycling at marinas, boat yards, and boat dealerships. Plastic shrink-wrap is increasingly being used to winterize boats and to package new boats for delivery. As plastic film collection and recycling opportunities are increasing in California, programs for collection and recycling of boat shrink-wrap should be developed.

Potential Implementers: CIWMB, SPI, California Resource Recovery Association, marina associations

Commercial Shipping

California's ports and associated maritime industries are major contributors to California's economy. Three of the five largest ports in the United States are located in California (Long Beach, Los Angeles and Oakland).[119] Despite the economic benefits associated with port operations, improper management of vessel waste threatens other economic resources, including clean beaches and healthy marine ecosystems.

California's ports are home to cargo ships, passenger cruise ships, and large commercial fishing vessels. Ports may lack adequate receptacles for receiving waste, programs to divert wastes to recycling facilities, or controls to prevent trash release during offloading and transfer. High costs and lack of convenience associated with handling garbage from ships and larger vessels contribute to poor management practices with respect to vessel wastes. The composition of waste from larger vessels and ships includes typical trash items found in households plus commercial waste, galley waste, and fishing gear.

ACTIONS RECOMMENDED

ACTION #34

Improve pleasure and commercial shipping in-port materials management. The high cost of garbage disposal in ports provides a disincentive for proper refuse disposal. "Non-conventional" commercial shipping, such as single charter operations, are a particular concern because their waste management is

[119] Ocean Protection Council, California Resources Agency, "California's Ocean Resources: An Agenda for the Future" 1997 – The report indicates that the industry provides a $6 billion dollar annual contribution

less visible than that of passenger cruise ships, which are expected to arrive in port with significant quantities of solid waste. This action should:

- Increase enforcement of MARPOL Annex V onboard monitors and make examples of bad actors to provide an incentive for compliance.
- Determine whether high port waste management fees contribute to at sea dumping. Conduct an investigation; possibly by conducting an anonymous survey of vessel operators.
- Do not separate out port dockage fees or identify refuse disposal as a separate line item because vessel operators may try to avoid the charge by dumping waste at sea. Garbage fees should be charged regardless of whether a ship has garbage to dispose of.
- Provide incentives for proper waste management. For example, provide a reduction in port fees for bringing in waste and additional incentives for recycling.

Potential Implementers: Increased enforcement of MARPOL – U.S. Coast Guard. Investigation of port fees relationship to at-sea disposal – NOAA. Changes in rate structure for waste disposal and increase in services for waste and recycling – California ports

ACTION #35

Conduct a needs assessment to determine whether adequate garbage and recycling services are available at all California ports. Once the assessment is complete, recommendations for improving garbage and recycling services at California ports should be provided and implemented.

Potential Implementers: CIWMB, DOT, California Port Captains and Harbormasters Association, other port managers associations

Construction

The construction industry accounts for 60% of all raw materials in use in the U.S., excluding uses for food and fuel.[120] An estimated 360 million tons of construction and demolition debris are generated in the U.S. annually. Of this, approximately 136 million tons are building related and only 20-30% is recycled.[121]

New development, redevelopment, and road and highway construction can cause polluted runoff. The U.S. EPA identifies construction materials as one of the sources of urban runoff pollutants.[122] These materials include metals from flashing and shingles, gutters and downspouts, galvanized pipes and metal plating, hydrocarbons, organic chemicals, paint, and wood. Litter from construction sites is also a source of pollutant loading in urban runoff.

Construction debris and waste are regulated under the SWRCB's storm water pollution control program. In addition, section 6217 of the Coastal Zone Act Reauthorization and Amendments (CZARA) requires that coastal states implement management measures for the control of nonpoint source pollution in coastal waters.[123] Construction waste discharges are considered nonpoint source pollution.

There are different approaches to preventing the migration of construction wastes and trash from construction sites to the storm drain system. Structural controls at the construction site are the most likely method for trapping trash and debris before it enters a storm drain system. Examples of typical storm water pollution controls used at construction sites controls include catch basin inserts that include sand filters, other

[120] U.S. Geological Survey, *Materials Flow and Sustainability: Fact Sheet*, June 1998, FS-068-98. http://pubs.usgs.gov/fs/fs-0068-98/fs-0068-98.pdf

[121] Personal communication with Timone Hoods, EPA Region IX, anticipating the issuance of a new EPA Construction Waste Characterization Report due out in 2005. For more information on construction waste and this new report, visit EPA's website at: http://www.epa.gov/epaoswer/non-hw/debris-new/basic.htm

[122] U.S. EPA, *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters*, Washington, D.C. (January) 1993 4-8.

[123] Id. at 4-3.

filtering inserts, and/or oil/grit separators. Non-structural controls focus on the waste management practices of construction site operators, including education of employees and providing waste collection and recycling services. Both structural and non-structural controls should be used in combination to control construction site discharges of trash and debris.

ACTIONS RECOMMENDED

ACTION #36

Provide training and education programs for public officials (site inspectors), contractors, and others involved in construction site operation. Such training should provide an understanding of the connection of urban runoff, both wet and dry weather, to impairment of local water bodies. Furthermore, participants should be informed about how to prevent such pollution.

Potential Implementers: U.S. EPA, U.S. Department of Energy, State and local storm water programs, construction and building trade associations

ACTION #37

Require that construction projects include adequate garbage collection and recycling at construction sites. State and local storm water programs should require that construction sites provide trash dumpsters and recycling collection bins. The receptacles should be covered and protected from weather and rodents. Site operators should be required to provide adequate service of waste receptacles such that they do not leak, spill, or overflow. Storm water Pollution Prevention Plans (SWPPP) should include the provision of such services. Local storm water programs should inspect construction sites for compliance.

Potential Implementers: State and local storm water pollution prevention programs

ACTION #38

Require builders to implement "good housekeeping" or BMPs at construction sites. SWPPPs should identify good housekeeping practices, and inspectors should ensure that such practices are implemented. Examples of good housekeeping measures include: sweeping of parking lots; adequate waste collection; and signs and management efforts to educate construction workers about keeping the site clean.

Potential Implementers: State and local storm water pollution prevention programs

ACTION #39

Require construction sites to be designed with structural controls to trap and divert trash and debris from runoff as necessary to prevent discharges. The types of systems that are typically used include catch basin inserts, vortex/screening separation units, nets, and booms.

Potential Implementers: State and local storm water pollution prevention programs

ACTION # 40

Require installation of physical and structural controls for preventing trash and debris from entering the storm drain system in final permit conditions for new construction and development. Such controls should be a condition for permitting of any new construction, commercial or residential. Many construction projects include modern finishes which use spray on plastics. Dusts from sanding these finishes need to be prevented from airborne transport off the construction site.

Potential Implementers: State and local storm water pollution prevention programs and local building permit departments

ACTION # 41

Minimize waste during construction, renovation, and deconstruction. Project plans should consider waste minimization, reuse and recycling during construction and deconstruction. Projects should be built for disassembly. Information and opportunities for deconstruction, salvage, and reuse are available from the Building Material Reuse Association. Many California municipalities require construction companies to recycle 50% of materials and to make a deposit to guarantee this.[124]

Potential Implementers: Developers, builders, builders associations, the construction trades, storm water agencies

Garbage Management

Several garbage management activities can increase the amount of trash and debris that is discharged to the marine environment. Garbage trucks that are not properly secured or operated can release trash. Landfills sited near water bodies can be a source of trash and debris due to wind-blown garbage. Open dumpsters at commercial establishments, outside residences, and in public facilities can also be a source of wind-blown trash. Persistent materials can inadvertently be released to waterways during solid waste transfer operations.[125]

ACTIONS RECOMMENDED

ACTION #42

Update regulations for landfills in California to include controls to prevent the release of trash to surrounding streets and waterways and provide enforcement of these standards. California landfill regulations address blowing litter in through the requirement of cover (Division 2 of Title 27 section 20695) and a specific requirement to routinely collect, control, and dispose of litter (section 20830).[126] NPDES General Permit No. CAS000001 from the SWRCB requires that landfill operators ensure that storm water discharges are in compliance with discharge prohibitions and ensure practices to reduce or prevent pollutants in storm water and authorized non-storm water discharges.[127] The NPDES permit doesn't specifically address trash or litter, but it does require that operators develop a storm water pollution prevention plan (SWPPP) for each facility. SWPPPs often include the implementation of structural overhead coverage, retention ponds, control devices, secondary containment structures, and treatment.[128] City and County regulations related to operation of landfills often specifically provide that litter must be controlled using continuous inspection and removal and litter fences.

Regulations should specifically require all landfill operators to install adequate structural and non-structural controls to prevent release of trash at landfills. Controls on-site include frequent cleanup of trash to prevent wind from blowing materials off-site, catch basin screens and inserts, and water quality inlets. Off-site controls include installing debris nets and fences where necessary to catch wind-blown trash, cleaning out storm drains adjacent to the facility, and cleaning littered beaches and waterways impacted by the facility.

[124] See Model Ordinances at http://ciwmb.ca.gov/ConDemo/SampleDocs/

[125] U.S. EPA, *Methods to Manage and Control Plastic Waste*, at 3-13

[126] Id.

[127] Id.

[128] Id.

Potential Implementers: SWRCB, CIWMB

ACTION #43

Provide adequate numbers of trash dumpsters and recycling receptacles at commercial establishments and public venues and make sure they are adequately maintained. Local regulations should require that commercial establishments and public venues provide adequate numbers of trash and recycling receptacles and service adequate to prevent overflows even during peak usage. Local health inspectors should be charged with ensuring that such containers are properly maintained.

Potential Implementers: Local storm water management and public health programs for inspections and enforcement. Implementation conducted by commercial establishments

ACTION #44

Increase enforcement against commercial establishments and homeowners that repeatedly improperly handle garbage. Failure to properly manage garbage is characterized by uncovered dumpsters and trash containers, overflowing trash dumpsters, lack of cover or containment of trash, and putting recyclable materials in the wrong bins. Residences and commercial establishments must be encouraged to prevent these problems.

Potential Implementers: Local public or environmental health departments

Pre-production Plastic and Industrial Discharges of Plastic

Pre-production plastics (in the form of pellets or powders) are discharged to waterways during the transport, packaging, and processing of plastics when BMPs (i.e., proper housekeeping practices) are not adequately employed. For pellets transported by rail, cars are emptied via a tubular valve that connects to a conveyance hose. The valve should be capped when not in use. Caps are sometimes improperly replaced causing pellet loss within the rail yard adjacent to a facility. A similar conveyance system exists for resins transported by hopper trucks. Pellets and powders escape when hoppers are emptied through pipes connected to tubular valves at the bottom of the truck. Valves are sometimes improperly closed after unloading, causing spillage to the yard.

When handled improperly, resin pellets and powders are released from conveyance mechanisms. In addition to plastic resins, additives used for coloring or creating specific characteristics of processed plastics are also delivered in pellet and powder form. The discharges to local waterways often include colorants and additives, not just plastic resins. Ground plastic parts and fragments from the processing of plastics are often part of the mix of debris that is conveyed by wind, storm water, or runoff from plastics facilities to storm drains and nearby waterways.

Pellets, powders, and fragments are widely dispersed from their places of origin. The impacts of powders and plastic debris smaller than pellets are not known but ingestion by plankton and other small marine organisms does occur.[129] The impacts of pelletized and powdered plastic additives, such as colorants and chemicals, in the marine environment are not well understood as research is in the initial phases.

Operation Clean Sweep (OCS) is a program of voluntary BMPs that was first developed in 1980 by SPI. It was recently revised and improved by a collaborative effort between APC and SPI to conduct outreach effort about OCS to plastics facilities in California. The program is supported in California by a multi-media effort

[129] Thompson, R.C.

to boost its outreach, including web-based materials (www.opcleansweep.org), trade show displays, rail car stickers, and training workshops.

ACTIONS RECOMMENDED

ACTION #45

Contain pellet, powder, and fragment discharges from plastics facilities through increased enforcement of storm water regulations. Increase the use of BMPs, such as those contained in OCS, by requiring plastic facilities to have an industrial storm water permit that specifies BMPs similar to those suggested by OCS, and inspect to ensure that the BMPs are being implemented. RWQCBs and local storm water programs should increase enforcement against plastics facilities that discharge plastic debris to storm drains and adjacent waterways in order to provide a deterrent to other facilities that violate water quality regulations. Fees obtained from increased enforcement should be used to generate funds for additional increased enforcement and for education of plastics facility operators in California about implementing BMPs. Permits should require BMPs and monitoring for the following types of plastic debris: pellets; fragments, regrind materials, and powders.

Potential Implementers: SWRCB and RWQCBs

ACTION #46

Educate State and local storm water regulatory programs about the problems and solutions to plastic debris discharges from industrial operations. Many agencies at the federal, state, regional and local levels are involved in the regulation of industrial discharges. Agency staff may not be aware of the problems associated with storm drain discharges from plastics industries. Agency staff should become familiar with the problems associated with plastics transport and processing and with the BMPs recommended in OCS.

Potential Implementers: Plastics industry trade associations, RWQCBs, SWRCB, nonprofit organizations

ACTION #47

Develop an OCS certification Program (similar to Green Business Programs). Encourage companies that buy plastics to patronize the plastics producers that are OCS certified. The certification program should involve certification performed by an independent government, research, or nonprofit organization. Trade and industry groups should provide incentives to member companies that demonstrate OCS implementation. Businesses should be provided with incentives for participation, including recognition in trade journals and by government programs, and the ability to market themselves as OCS-certified. The Environmentally Preferred Rating (EPR) certification program being launched by CFECA should be considered as a possible basis for an OCS certification program.

Potential Implementers: Plastics industry trade associations (SPI, APC, CFECA)

ACTION #48

Educate the plastics industry about storm water compliance and BMPs. Promote increased industry awareness of storm water regulation through OCS, trade publications, and conferences. Educate facility operators about compliance benefits, including the cost benefits of reducing: (1) pellet loss (i.e., materials costs), (2) workplace injuries and insurance costs, and (3) potential fines related to enforcement. Include education about environmental impacts of plastic pellet and powder discharges.

Potential Implementers: Plastics trade associations, storm water regulatory programs, and environmental nonprofits

ACTION #49

Update OCS to include additional BMPs and information. OCS should be updated with information about compliance with storm water regulations. It should also be updated to include BMPs that address the following:

- Not all facilities receiving shipments in "super sacks" have the equipment to handle them (they can be bigger than fork lift capacity), and need to empty into an interim container.
- The need for durable (hard plastic) reusable transport containers.
- Consider possible modifications to shape and form of plastic (instead of easily dispersed round pellets). It may be possible to modify the properties of the pre-production pellets so that they are less likely to be spilled, blown, or washed into waterways.
- Encourage reduction of pre-production plastics through re-pelletizing scrap. Some facilities are exploring how to increase "re-pelletizing" resin scrap and onsite storage to reduce their overall need for virgin resins.

Potential Implementers: APC and SPI

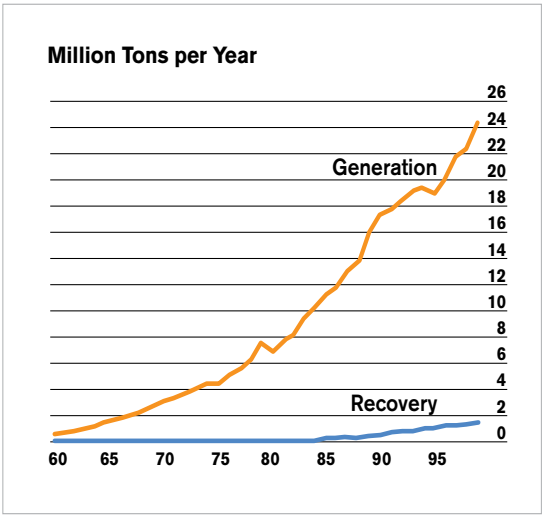
—4—
Actions to Reduce Product Waste

Commensurate with society's increasing reliance on packaging and disposable consumer goods, the quantity of trash has continued to increase. The increasing quantity of waste provides increased opportunities to litter. Thus, while people are directly responsible for littering, the increased amount of waste is also a factor in the increasing quantity of litter. Between 1960 and 2003, the average amount of garbage generated per person per day in the U.S. increased from 2.7 pounds to 4.5 pounds, a 60% increase.[130] The U.S. EPA suggests that "[t]he most effective way to stop this trend is by preventing waste from being generated in the first place."[131]

Garbage generated by households, including trash and organic wastes, is considered Municipal Solid Waste (MSW), a term derived from the regulation of waste in the United States. Based on U.S. EPA's statistics for 2003, product waste comprised 75% of MSW by weight, and 89% by volume.[132] Since marine debris from land-based sources is comprised almost entirely of product waste, it is this large portion of the MSW stream, as well as product waste in the commercial waste stream, that should be a focus of concern with respect to reducing marine debris from land-based sources.

Plastics are the fastest-growing portion of the MSW stream. Plastics represent a disproportionate share of landfill space. Next to paper, plastics are the second-largest category of waste by volume going into municipal landfills.[133] Only a small fraction of the overall plastic waste stream is recycled in the U.S. (see Table 2). The CIWMB doesn't provide a numeric figure for overall plastics recycling in California in its latest reports.[134] California reported a plastic waste diversion rate of 2.9% in 1990.[135]

TABLE 2:
Generation and recovery of U.S. plastics



Source: Integrated Waste Management Board, *Plastics White Paper*, p. 8

Reduction of marine debris can be accomplished by reducing the amount of product waste generated because it is the products portion of the waste stream, not the organic materials portion, that become marine debris. Reducing the quantity of product waste in the MSW stream can be accomplished by: (1) waste reduction; (2) discouraging product waste generation in California; and (3) changes in product

[130] http://www.epa.gov/msw/facts.htm; U.S. EPA, "Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2003," . 3 http://www.epa.gov/msw/pubs/msw05rpt.pdf

[131] Spiegleman at 10-11 citing U.S. EPA. 2003. "Municipal Solid Waste in the United States: 2001 Facts and Figures. US Environmental Protection Agency, p. 114. Available at http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

[132] Helen Spiegelman & Bill Sheehan, "Unintended Consequences: Municipal Waste Management and the Throwaway Society" Product Policy Institute (March 2005) 1. Available at http://www.productpolicy.org/assets/resources/UnintendedConsequences-MSWandEPR.pdf. Among the product categories of MSW generated in 2003 in the United States, the U.S. EPA determined that containers and packaging made up the largest portion at 31%, followed by nondurable goods (food packaging, beverage containers and other disposable goods) at 26%, durable goods (non-disposable consumer products) at 16.7%, food scraps at 11.7%, yard trimmings at 21.1%, and other waste at 1.5%. This information and more statistics on MSW in the U.S. can be found at http://www.epa.gov/msw/pubs/msw05rpt.pdf

[133] Integrated Waste Management Board, *Plastics White Paper: Optimizing Plastics Use, Recycling, and Disposal in California* (May 2003) 7-8

[134] Id.

[135] Integrated Waste Management Board, *Market Status Report: Postconsumer Plastics*, (October 1996) 1.

packaging and design. Innovations that give waste "value" so materials (after use) are not disposed of, but re-used, also hold promise. Such innovations involve changing the life-cycle of materials from the current system of "cradle to grave" management, in which products are consumed and then disposed, to a "cradle to cradle" system, wherein products after they are consumed still provide value as another product.[136]

Actions recommended in this section include the following strategies:

- **Increasing Waste Reduction**
- **Reducing Waste Generation in California**
- **Changes in Product Packaging and Design**

Increasing Waste Reduction

The CIWMB defines "waste reduction" as "the combined efforts of waste prevention, reuse, composting, and recycling practices." "Waste prevention" is defined by the agency as "(a)ny action undertaken by an individual or organization to eliminate or reduce the amount or toxicity of materials before they enter the municipal solid waste stream. This action is intended to conserve resources, promote efficiency, and reduce pollution."[137] In reality, waste reduction efforts in California and the U.S. do not prevent waste from being generated. Rather, they focus on diverting it from landfills, which is the result of the "Integrated Waste Management" approach encouraged by the federal government through enactment of the "Resource Conservation and Recovery Act" (RCRA) of 1976 and amendment in 1984.

California adopted this waste management program in 1989 with the passage of AB 939, the Integrated Waste Management Act. The Integrated Waste Management approach establishes a hierarchy of waste management strategies that includes: source reduction of wastes before they enter the waste stream (including reuse of products and backyard composting of yard trimmings); recovery of generated wastes for recycling (including composting); and environmentally sound disposal through combustion facilities and landfills that meet current standards.[138] The following actions recommended are consistent with the current system of integrated waste management in California.

With respect to plastic, several notable programs are already in place in California to achieve diversion and waste reduction, including:

- Initiatives undertaken by the CIWMB to increase plastic film and plastic container collection and recycling;[139]
- The Beverage Container Recycling and Litter Reduction Action that requires that redemption centers offer refunds for returned containers under the California Redemption Value (CRV) program;[140]
- The Rigid Plastic Packaging Container (RPPC) law that was enacted and is implemented as part of the CIWMB's efforts to increase the use of recycled plastic and reduce the amount of plastic waste disposed in California landfills;[141]
- The Recycled Content Trash Bag program in which plastic trash bag manufacturers selling trash bags in California are required to meet either one of the following:

[136] The concept of "cradle to cradle" materials production was developed and described by William McDonough and Michael Braungart in *Cradle to Cradle: Remaking the Way We Make Things* North Point Press, 2002.

[137] http://www.ciwmb.ca.gov/bizwaste/factsheets/define.htm

[138] U.S. EPA. 2003. *Municipal Solid Waste in the United States: 2001 Facts and Figures*. US Environmental Protection Agency. Available at http://www.epa.gov/epaoswer/non-hw/muncpl/msw99.htm

[139] Written communication, November 15, 2005 from Christine Flowers, CIWMB. Information about this effort is available on the Board's website: www.ciwmb.ca.gov.

[140] A description of California's Beverage Container Recycling and Litter Reduction Program is provided at http://www.conservation.ca.gov/DOR/gpi/CRVFactSheet905.pdf

[141] Information about this program is available on the CIWMB website at: http://www.ciwmb.ca.gov/Plastic/RPPC/

1. Plastic trash bags contain a quantity of recycled plastic post-consumer material (RPPCM) equal to at least 10% of the weight of the regulated bags.
2. At least 30% of the weight of material used in all of its plastic products is RPPCM.[142]

Many other programs exist to encourage recycling of products in the waste stream, such as batteries, tires, hazardous wastes, electronic wastes, organic wastes. The recommendations included in this section are intended to increase source reduction of consumer waste and thereby reduce marine debris.

ACTIONS RECOMMENDED

ACTION #50

Encourage consumers to reduce their use of single-use disposable goods and packaging through education, consumer fees, and incentives. Consumers need to understand the connection between the use of single use disposable products and the depletion of natural resources, and impacts on the marine environment. Increased efforts are needed to educate consumers about the environmental impacts associated with convenience. Consumers may be persuaded to forego the use of a certain amount of convenience-oriented packaging and single-use disposable goods through a combination of education and fiscal incentives or disincentives. An education program should develop and test the effectiveness of messages that encourage consumers to reduce consumption and change purchasing behavior. Incentives or disincentives should be tested in pilot programs that implement measures such as charging an additional fee for single use disposable goods (for example, non-reusable cups, containers, and bags) or offering a discount for consumers that bring their own cup, bag, or container.

Potential Implementers: CIWMB, local waste management agencies, local ordinances regarding fees and incentives. Nonprofit organizations can implement education

ACTION #51

Increase plastic bag recycling. Increasing recycling is one method for reducing litter.[143] Plastic bags are a known and significant part of the marine debris problem. Government and commercial establishments should provide convenient opportunities for the consumer to recycle at all areas where plastic bags are distributed or in use at home (through curbside collection) and at retail outlets. Grocers and retailers should be strongly encouraged to provide opportunities for the public to return plastic carry out bags to stores for recycling.

Potential Implementers: CIWMB, Progressive Bag Alliance, restaurant and grocery trade associations, film and bag association, local waste management and recycling programs

ACTION #52

Increase recycling of plastic non-beverage containers and packaging waste in California. The greatest success in plastic recycling in California is the recycling of plastic beverage containers. The CRV (redemption value) provides and incentive for consumers to collect and recycle these containers. Non-beverage plastic containers include food containers (such as yoghurt and milk containers) and product containers and packaging (such as blister packs). These items are rarely recycled. An evaluation of barriers to container recycling should be performed and solutions implemented. Some solutions include:

[142] A more detailed explanation of the program is provided by the CIWMB at: http://www.ciwmb.ca.gov/BuyRecycled/TrashBags/#Requirements

[143] http://www.arizonacleanandbeautiful.org/research.html cites research by Dr. Ingrid E. Schneider, Dept. of Recreation Management & Tourism, College of Public Programs – "Exploring Norms and Behaviors Related to Litter & Recycling Among Arizona Residents & Visitors."

- Increase recycling of all types of plastic containers by increasing recycling markets and addressing other constraints.
- Increase recycling by increasing consistency of products recycled among all local jurisdictions in California.
- Increase recycling at areas not currently well serviced, such as, rural communities, large venues, high-rise multi-family buildings, and office environments.
- Increase recycling by developing local markets for a wide array of recycled plastic materials.
- Increase recycling through encouraging producers to use packaging that is currently accepted for recycling in most of Californian curbside programs (i.e., with plastics, using resin types 1 and 2 for containers)
- Promote products made from recycled materials.
- Promote new technologies for recycling plastics.
- Improve recycled content requirements for containers such that they effectively increase the use of recycled content.
- Prohibit the use of composite materials in containers that prevent recycling.

Potential Implementers: CIWMB

ACTION #53

Investigate the feasibility of creating a CRV refund for non-beverage containers. The CRV refund on beverage containers has been successful in promoting recovery and recycling of beverage containers. A similar program for non-beverage containers might significantly reduce the amount of container waste.

Potential Implementers: CIWMB, Legislature, nonprofit organizations

ACTION #54

Develop a labeling system that clarifies which plastics are recyclable. In order to identify plastics capable of being recycled, the chasing arrows symbol surrounding a number on plastics was developed. The chasing arrows lead some to believe that the product is recyclable. Many consumers cannot identify what's recyclable using the numeric system. Consumers need a simple way to identify products that are recyclable. Critics of the current plastics labeling system find fault with using a recycling logo on plastics that are not typically recyclable. However, since items that can be recycled vary among municipalities, it is not possible to label all products the same way. One logo indicating a product is recyclable would have to be affixed locally on products that can be recycled locally. One option is to use chasing arrows only on products that are universally accepted in all recycling programs (for example, bottles of 1 and 2 resin types). A simple system needs to be developed to identify plastics that are recyclable.

Potential Implementers: CIWMB, municipal solid waste management programs

ACTION #55

Provide business incentives for source reduction. Encourage the procurement policies of government agencies and commercial enterprises to favor source reduction. Identify cost-savings opportunities for industries to use less packaging by providing cost-benefit analysis. Provide tax breaks or subsidies to companies that use environmentally preferable packaging and other source reduction techniques. Encourage pressure from retailers on producers to reduce packaging. Provide awards to companies that develop products that can be recycled as the same product at the end of their use.

Potential Implementers: Tax breaks or subsidies/investigation by the CIWMB – the Legislature. Pressure on producers by retailers– nonprofit organizations

ACTION #56

Reduce commercial business waste by implementing in-store waste reduction measures and educating customers in ways to reduce waste. The CIWMB has developed industry-specific fact sheets for restaurants, retailers, hospitals, hotels, landscapers, legal offices, meetings and conferences, offices, printing and property management that provide recommendations for reducing waste.[144] For example, food establishments can provide a discount to customers that bring their own bag or cup. Retail stores should train clerks and food service employees in methods to promote source reduction, such as, reducing the number of shopping bags packed per consumer, or asking if a bag or take-out cup is needed. These types of recommendations need to be encouraged through intensive outreach programs combined with incentives, such as a green business certification program for various industries. The trade associations that represent the various business groups should be more actively involved in promoting waste reduction programs. Leading chain stores should set examples.

Potential Implementers: CIWMB, DOC, nonprofits, retail and grocer trade associations, packaging producers and trade associations, big box stores and retail chains

ACTION #57

Model source reduction in schools. School administrations, faculties, and students should be engaged in the effort to reduce trash and debris through source reduction. Focus source reduction efforts on school lunch programs and have students find opportunities for source reduction. Engage students who are studying recycling and source reduction to develop source reduction programs/guidelines for their school and help to implement them. Develop state-wide recommendations for schools and large institutions on how to hold "trash free" events. Several "green school" programs and initiatives exist. The goal should be to promote them in a coordinated manner throughout the State such that all schools get involved.

Potential Implementers: CIWMB, local school districts, California Association of Independent Schools, nonprofit organizations

ACTION #58

Impose limits, bans, and prohibitions on materials that more commonly become litter and marine debris. Various types of limits, bans, and prohibitions can be used to reduce the amount and types of packaging. A number of strategies have been employed by different countries as well as local governments in an effort to combat this problem.[145] Options include:

- Prohibiting disposable packaging for certain products;[146]
- Making packaging reduction mandatory (such as, requiring large containers of condiments versus packets at take out food establishments and large venues);
- Banning expanded polystyrene foam containers, grocery bags, and other single-use disposable items that are significant components of marine debris from land-based sources;
- Imposing taxes or fees on the sale of single use disposable containers, food packaging and containers, or carry bags; and

[144] http://www.ciwmb.ca.gov/BizWaste/FactSheets/#Industry

[145] As many California jurisdictions have done already. See discussion on pp. 33-34.

[146] For example, Denmark requires refillable containers for all packaging of domestic beer, soft drinks, and mineral water and bans cans for both domestic and imported beer, soft drinks and mineral water. http://www.grrn.org/beverage/refillables/Europe.html#Finland The primary difference between programs in the U.S. and other countries is that the U.S. has no governing federal agency in charge of litter reduction programs. Denmark, Ireland and Singapore have national regulatory mandates to reduce litter.

- Imposing taxes on commercial establishments whose packaging and products are the source of significant portions of litter and marine debris.

Municipalities that impose limits, bans, or prohibitions on certain products or materials should assess the effectiveness of the programs at achieving reductions in marine debris.

Potential Implementers: Local jurisdictions, the Legislature, nonprofit organizations

Reducing Waste Generation in California

California's Integrated Waste Management Act (IWMA), also known as AB 939 (Chapter 1095, Statutes of 1989), created the CIWMB and required that local jurisdictions in the state achieve a diversion rate for solid waste going to landfill of 25% in 1995 and 50% in 2000.[147] This diversion is accomplished primarily through organics composting and solid waste recycling. In 2004, the CIWMB's estimated state-wide diversion rate was 48%, to date the closest year in achieving the target of 50% set for 2000.

In California, the main focus of solid waste management has been increasing waste diversion from landfills. Much less attention has been paid to reducing the overall quantity of waste being generated. From a litter and marine debris perspective, however, the quantity of waste being generated is an important measure because the more waste there is to manage, the greater the opportunity for it to become litter. All three rates (generation, diversion and disposal) have been steadily increasing since the implementation of the Integrated Waste management Act in California. For example, in 1995 in California the overall diversion rate for waste from landfills was 28% while the quantity generated was 50 million tons and the quantity disposed was 35 million tons.[148] Following a steadily increasing trend in generation, diversion, and disposal, in 2004 California generated nearly 80 million tons of solid waste, diverted 48%, and disposed of 42 million tons. Even though the percentage of waste recovered rose from 28% to 48%, the overall quantity of waste generated and disposed increased significantly. Therefore, the amount of waste needing to be managed (and available to be littered) is on a steady upward increase with no mandated limits.

Generating large quantities of waste causes numerous environmental impacts, not just an increase in marine debris. The European Union (EU) responded to the problem by developing an entirely different system of waste management aimed at reducing the quantity of wastes generated. This system, imposed by directives to member States by the EU, places the responsibility for managing and disposing of waste on the industries that produce and sell the products that become waste. This system is called "Extended Producer Responsibility" (EPR).

EPR has emerged as a promising alternative to Integrated Waste Management for product wastes. In EPR systems, products at the end of their useful lives are managed through an infrastructure arranged by the producers and provided to consumers as an expected customer service. The approach, often referred to as producer "take back," was introduced in Germany in 1991, when product brand-owners started being required to provide for the recycling and disposal of the packaging associated with their products pursuant to a Packaging Directive.[149]

In Integrated Waste Management in the United States, producers and retailers of products have no responsibility for the products once the product is sold to a consumer. The management and ultimate disposal of the product becomes the financial and physical responsibility of municipal government. By placing the financial and physical responsibility for products once they are discarded on the producers, EPR provides

[147] http://www.ciwmb.ca.gov/LGCentral/Glossary.htm#IWMA

[148] These figures obtained by comparing the information provided on the "Local Government Central" portion of the CIWMB website: http://www.ciwmb.ca.gov/LGCentral/Rates/Graphs/TotalWaste.htm. http://www.ciwmb.ca.gov/LGCentral/DRS/Reports/State-wide/SWTotalGrf.htm

[149] Spiegelman at 2.

a financial incentive to the producer and retailer to reduce the quantity of waste they have to manage.[150] By connecting the front end (manufacturing) to the back end (disposal), EPR creates a front-end incentive to design products and product packaging to make them less wasteful and more recyclable. The following ACTIONS RECOMMENDED focus on reducing "product" waste, a characterization of solid waste that encompasses all packaging and durable and non-durable goods.

Many countries around the world have responded by implementing various forms of producer responsibility or shared responsibility for waste management. Some of these programs involve sharing responsibility for the costs and physical handling of waste between consumers, local government and private industry. Following this model, the U.S. EPA has embraced the concept of "product stewardship," that it describes as: "…a product-centered approach to environmental protection. It calls on those in the product lifecycle–manufacturers, retailers, users, and disposers–to share responsibility for reducing the environmental impacts of products."[151] Currently, producers and manufacturers of packaging and single-use disposable goods in the U.S. bear no financial or physical responsibility for products once they become a waste.

ACTIONS RECOMMENDED

ACTION #59

Investigate reducing volume of products solid waste generated if California were to adopt an EPR program. An investigation of current systems of extended producer responsibility world-wide is needed to determine whether any models are effective at reducing the quantity of product waste generated and whether such models are suitable to California. The investigation should include models that address the durable and non-durable goods that are typical in the California MSW stream. The results of the investigation should be reported to the CIWMB and the California Legislature.

Potential Implementers: CWIMB, research and academic institutions, nonprofit organizations such as Californians Against Waste

ACTION #60

Investigate reducing the volume of product waste through a system of shared responsibility for waste. Models for waste management implemented globally include systems of shared responsibility for product waste among producers, consumers, and municipal government. The potential for systems of shared responsibility for reducing the volume of wastes generated should be investigated and compared to EPR models to determine which has the greatest application for California in terms of reducing solid waste generation.

Potential Implementers: CWIMB, nonprofit organizations

Changes in Product Packaging and Design

Changes in product design and packaging can achieve waste reduction and reduce impacts on the marine environment. An example of a product or packaging design that has simply reduced litter and thereby the potential to contribute to marine debris is the design of the pull-tab on aluminum cans. These tabs were initially designed as a pull-off piece of the containers and, as a result of legislative mandate, were rede-

[150] An explanation of EPR is provided by Raymond Communications, experts in global recycling policy: "The term "extended producer responsibility" is used when manufacturers ensure that their package or product is collected and recovered at its end of life. In Europe, there are laws in all 25 countries that require "take back" or otherwise tax manufacturers to ensure recovery of used packaging. Japan, Taiwan, and Korea also have such laws in various forms. Peru has a law authorizing take back regulations. Ontario and Quebec also have EPR laws. The U.S. is one of the few industrialized countries with no national EPR scheme. In all there are 30 countries with mandates on packaging; 15 have EPR laws for batteries, and 11 countries have "take back" on electronic products." Visit their website for more information at: http://www.raymond.com/packaging/#1

[151] http://www.epa.gov/epaoswer/non-hw/reduce/epr/

signed to remain attached to the cans. Straws, container lids, bottle caps, and cup holders are examples of packaging items that are frequent debris items in urban runoff and have potential to be integrated into the product package, thereby reducing sources of marine debris. Although a "California only" package in a global marketplace may not make sense, if these changes are proposed, California represents a large enough portion of the consumers in the U.S. that product design changes may be implemented beyond State borders. Companies perceive packaging designs as very important to product sales. Product manufacturers need to be convinced that consumers will find product changes acceptable before they willingly make product design changes.

ACTIONS RECOMMENDED

ACTION #61

Redesign packaging to reduce waste and impacts on the marine environment. This could be a joint effort between the State and the packaging industry. Research, develop, and implement alternative packaging that focuses on achieving source reduction by volume, not by weight, since in the marine environment it is the abundance of debris items, not the weight that has the greatest impact. Examples of useful alternative packaging concepts include:

- Redesign beverage containers to eliminate pieces that can become segregated from the beverage container, including lids, caps, straws, and cup holders
- Design packaging for reuse
- Design packaging for recycling
- Find alternatives to disposable bags, cups, and takeout containers
- Eliminate the need for packaging, wrap, and shrink-wrap through product redesign
- Use recycled content material to replace virgin feedstock whenever possible
- Develop packaging that degrades in the marine environment without harmful impacts

The Association of Post-Consumer Plastics Recyclers (APR) Design for Recycling Guide has been around for years, yet is not fully adhered to by most companies. The recommendations in this Guide should be considered.

Potential Implementers: the packaging industry, academic institutions, CIWMB, the Legislature, nonprofit organizations

ACTION #62

Develop an environmentally preferred packaging standard for California and a program for its implementation. Criteria for an environmentally preferred packaging should include focus on (1) minimizing the volume of waste that the package will create, (2) increasing the potential to recycle the package, and (3) reducing the package's potential impacts on the marine ecosystem. The program should provide incentives for businesses that use preferred methods. The program should address the issue of theft deterrence by promoting the use of electronic sensors. The program should develop a green packaging label for businesses based on the environmentally preferable packaging criteria and educate consumers about following the labels to make environmentally preferable purchasing choices. The program should include life cycle analysis of packaging, including environmental costs associated with materials and energy consumption.

Potential Implementers: University of California, CIWMB, nonprofit organizations

ACTION #63

Conduct a compostable and degradable litter study. Degradable and compostable packaging is becoming increasingly popular. The ASTM standards for degradable and compostable plastics provide standards for degrading and composting in compost situations. Therefore, these products are not being designed to degrade or compost on streets or in the marine environment.

An investigation is needed regarding whether degradable and compostable products entering the market place are: (1) more likely to be littered than non-degradable and compostable products; and (2) likely to have a negative impact on plastics recycling. Furthermore, such an investigation should determine whether there is any positive role that degradable and compostable plastics have with respect to the litter and marine debris problems.

Potential Implementers: CIWMB, DOT, the University of California

—5—
Funding Options

Almost all of the actions in this Plan require additional funding, in many cases, a substantial amount of it. Finding a substantial funding mechanism to support many of the actions recommended in this Plan is listed as one of the highest priorities at the outset of the Plan. Many of the actions in this Plan can be funded by two of the mechanisms discussed below: a litter tax or fee, and redemption fees on products for which the State wishes to encourage recycling. Many will have to be funded by grants and loans.

The California Legislature is constrained in imposing taxes to support new environmental initiatives by federal constitutional challenges that limit the types of taxes that can be imposed. A tax must satisfy a four part test: 1) it must be applied to an activity with a substantial nexus with the taxing State, 2) it must be fairly apportioned, 3) it may not discriminate against interstate commerce, and 4) it must be fairly related to the services provided by the State.[152] What is required is "some definite link, some minimum connection, between a state and the person, property or transaction it seeks to tax."[153]

The distinction between a tax and a fee has important legal consequences for governments and taxpayers. In general, courts have ruled that local taxing powers must be granted in state constitutions or by legislative authority. Fees, however, may be imposed without specific constitutional or statutory authority as part of the exercise of local regulatory (police) powers. Taxes are harder for lawmakers to enact because some taxpayers perceive taxes to place a financial burden on them for benefits that they do not in fact receive. On the other hand, fees are generally assessed based on services received by the payer and are therefore less controversial.[154]

FUNDING MECHANISMS

Litter fees or taxes

Despite the impediments mentioned above, many of the participants in the development of this Plan suggest that the actions recommended should be financed by a State tax or fee imposed on products that either significantly contribute to marine debris or litter. A litter fee has the potential to generate a very significant source of funds. However, before a litter or marine debris fee can be developed, research to better identify the products that contribute significantly to marine debris or to litter in California must be completed, as recommended in Actions #4 and #5.

Current research regarding marine debris already shows that smoking litter (cigarette butts) is one of the most prevalent forms of marine debris on beaches and in urban runoff. There is adequate data to support a cigarette tax to help fund marine debris and litter cleanup and reduction efforts.

Bond measures

In 2004, Los Angeles City residents overwhelmingly supported Proposition O and authorized the City to issue $500 million in general bonds for projects that protect public health by improving water quality. These projects include cleaning up and preventing pollution of waterways and beaches, improving or protecting water quality, and increasing water conservation, habitant protection and open space. Local governments can finance many of the actions recommended in this Plan through bond measures, but the voters must approve these measures.

[152] *Complete Auto Transit, Inc. v. Brady* (1977) 430 U.S. 274 {51 L.Ed.2d 326, 97 S.Ct. 1076}. The nexus test is a requirement that is linked to both the commerce clause and the due process clause of the Fourteenth Amendment.

[153] *Quill Corp. v. North Dakota ex rel. Heitkamp* (1992) 504 U.S. 298, 312.

[154] National Conference of State Legislatures, "The Appropriate Role of User Charges in State and Local Finance," updated July 1999. http://www.ncsl.org/programs/fiscal/fpufmain.htm

Advanced disposal fees

Advanced disposal fees charge the consumer at the point of purchase for the services and costs related to the product's disposal once it becomes a waste product. An example in California is the "e-waste" charge associated with electronic wastes such as television monitors computer monitors, televisions, and similar video display devices (including lap top computers). The program places a $6-$10 Advance Recycling Fee on the sale of these products. The funds that are generated are used to provide incentives for local governments, nonprofits and private recyclers to establish recycling opportunities. Advanced disposal fees can be used to fund recycling and other programs related to wastes.

Redemption fees

Redemption fees, like the CRV fee for beverage containers, charge the consumer a fee on the beverage container at the point of purchase. The fee is redeemable when the consumer brings the container to a recycling center. The CRV provides consumers with an incentive to recycle. This concept can be applied to other products in California's waste stream that should be targeted as recyclable components of the litter and marine debris problem.

Enforcement fees

Many of the existing programs described in this Plan require increased enforcement. The collection of fines and fees based on enforcement can generate funds to provide additional funding for enforcement and regulatory programs.

Increased tipping fees at landfills

Increased tipping fees, or disposal costs, at landfills can help to fund local programs to reduce and control litter and to increase recycling. However, this option may result in the opposite of its intended effect. Public works agency officials feel there is a correlation between the increased frequency of illegal dumping of trash loads and recent increases in garbage disposal and landfill tipping fees.

Markets for materials

Currently, there is strong market demand for recovered plastic film. Collection programs may be established by joint efforts between local jurisdictions and the materials recovery industry without need for additional funding, as is currently happening with plastic films.

Grants and loans

Absent permanent sources of funding, agencies and organizations seeking to implement actions recommended in this Plan are likely to need funding assistance. The following list provides some links to appropriate funding sources for reducing trash and debris from land-based sources in California.

Grants from Federal agencies

Funding for water quality improvements, watershed protection, and marine debris reduction is available from Federal agencies. These links provide more information about available Federal agency environmental grant programs:

- **All federal grant opportunities:** www.fedgrants.gov
- **Resource conservation funding:** www.epa.gov/region09/funding/rcra.html
- **U.S. EPA innovation pilots:** www.epa.gov/oswer/iwg/announcement.htm
- **Catalogue of Federal funding sources for watershed protection:** www.cfpub.epa.gov/fedfund/
- **NOAA marine debris grant programs:** www.nmfs.noaa.gov/habitat/restoration/projects_programs/crp/partners_funding/callforprojects2.html
- **National Science Foundation grants:** www.nsf.gov/funding/research_edu_community.jsp

Grants from State agencies

State grants and loans are available to fund water quality and watershed protection, boating improvements, public education and outreach, ocean research and protection initiatives, and recycling efforts.

- **CCC Whale Tail grants:** www.coastal.ca.gov/publiced/plate/plgrant.html
- **CIWMB grants and loans:** www.ciwmb.ca.gov/Grants/
- **DOC grants and loans:** www.conservation.ca.gov/DOR/grants/index.htm
- **DBW grants and loans:** www.dbw.ca.gov/grantsloans.asp
- **Ocean Protection Council:** www.resources.ca.gov/copc/
- **SWRCB grants:** www.swrcb.ca.gov/funding/index.html#funding_programs

Private foundation grants

- **Foundations providing grants for environmental purposes:**
www.ncseonline.org/NLE/Links/LinksDetail.cfm?custom21=NLE%20Yellow%20Pages&custom22=Foundations

Funding from industry and commercial interests

Industry associations (representing plastics producers, marina and boating businesses, retail and grocer associations, and construction trades) can be considered a resource for funding. They have the ability to raise money from their membership. When a trade association wants to distinguish its membership from "bad actors" in the industry, they often mobilize and create certification programs or implement initiatives to solve environmental problems. They may do this independently or develop a cooperative program between industry and government. For example, if government agencies are unable to find funding to conduct enforcement, an industry association may create a board that charges members fees. The fees generated can be provided to local regulatory agencies to fund increased enforcement. A model for this exists within industries in the agricultural sector that created strawberry and kiwi boards to provide RWQCBs with funding needed for enforcement.

Summary of Actions Recommended to Reduce Marine Debris from Land-Based Sources

Actions to Address the Need for Improved Coordination

1. Provide a mandate to control marine debris and litter to one or two State agencies and provide funding for both programs.
2. Develop an Interagency Task Force on Marine Debris in order to assure adequate coordination and implementation of actions to reduce marine debris in California.

Actions to Address Research Needs

3. Conduct studies of trash in urban runoff and litter and marine debris "hot spots" throughout the State in order to characterize the most significant products contributing to the problem of marine debris from land-based sources.
4. Conduct research regarding potential bioaccumulation or other marine eco-system impacts of plastic additives.
5. Investigate the impacts on the marine ecosystem of micro-particles of plastics.
6. Develop standardized research protocol and provide baseline documentation on quantity of plastic accumulation rates in deeper waters, including source identification and trend analysis.
7. Determine the effects of rafting invasive species and ecological effects on benthic organisms.
8. Assess socio-economic impacts associated with littering and marine debris (i.e. impacts on tourism and fisheries).

Actions to Address Specific Sources of Land-based Discharges

LITTERING BY THE GENERAL PUBLIC

9. Provide adequate receptacles and collection of trash.
10. Provide adequate receptacles and collection of recyclable materials.
11. Reduce smoking-related debris by: (1) increasing enforcement against smoking litter; (2) providing adequate receptacles for cigarette butts; and (3) implementing a state-wide smoking litter outreach program.
12. Conduct preliminary research in order develop a state-wide anti-litter and marine debris campaign.
13. Implement a coordinated and continuous state-wide anti-litter campaign for the general public.
14. Implement local anti-litter / anti-marine debris education efforts in conjunction with programs aimed at building community pride.
15. Conduct research to determine whether messages regarding the costs of cleaning litter and trash are effective in motivating behavior changes.
16. Address littering caused by uncovered truckloads and illegal dumping.

17. Expand the reach and duration of watershed-based work/study education programs that connect school children to their community and to the environment.
18. Increase litter and marine debris education in schools (K-12).
19. Increase anti-litter enforcement by local authorities and the CHP, and by citizen reporting using a new litter reporting hotline.
20. Provide and maintain cigarette litter receptacles wherever patrons or employees congregate to smoke.
21. Ensure that municipalities prevent trash from entering the storm drain system.
22. Coordinate and regularize watershed-based cleanups.

LITTERING BY BEACH VISITORS

23. Increase the availability of trash and recycling receptacles and services at beaches state-wide.
24. Implement a state-wide beach visitor education campaign about litter and marine debris.
25. Increase enforcement of anti-littering laws at beaches.

LITTERING BY RECREATIONAL BOATERS AND COMMERCIAL FISHERMAN

26. Implement a program to assure that solid waste disposal and recycling opportunities are adequate for California boating.
27. Improve waste management by vessel operators in marinas and harbors.
28. Target boat rental facilities, boat launch ramps, and heavy usage areas (restrooms and parking lots) to improve solid waste management by recreational boaters and fisherman.
29. Work with the National Association of State Boating Law Administrators (NASBLA) to incorporate environmental standards, including marine debris minimization, into boating curriculum.
30. Include marine debris in boater education efforts.
31. Clean all boating and fishing-related trash from marinas, boat launch ramps, camping areas, and popular fishing areas.
32. Encourage enforcement of anti-litter laws at boating venues.
33. Implement shrink-wrap recycling at marinas, boat yards, and boat dealerships.

COMMERCIAL SHIPPING

34. Improve pleasure and commercial shipping in-port materials management.
35. Conduct a needs assessment to determine whether adequate garbage and recycling services are available at California ports.

CONSTRUCTION

36. Provide training and education programs for public officials (site inspectors), contractors, and others involved in construction site operation.
37. Require that construction projects include adequate garbage collection and recycling at construction sites.
38. Require builders to implement “good housekeeping” or BMPs at construction sites.
39. Require construction sites to be designed with structural controls to trap and divert trash and debris from runoff as necessary to prevent discharges.
40. Require installation of physical and structural controls for preventing trash and debris from entering the storm drain system in final permit conditions for new construction and development.
41. Minimize waste during construction, renovation, and deconstruction.

GARBAGE MANAGEMENT

42. Update regulations for landfills in California to include controls to prevent the release of trash to surrounding streets and waterways and provide enforcement of the standards.
43. Provide adequate numbers of trash dumpsters and recycling receptacles at commercial establishments and public venues and make sure they are adequately maintained.
44. Increase enforcement against commercial establishments and homeowners that repeatedly improperly handle garbage.

PRE-PRODUCTION PLASTIC AND INDUSTRIAL DISCHARGES OF PLASTIC

45. Contain pellet, powder, and fragment discharges from plastics facilities through increased enforcement of storm water regulations.
46. Educate State and local storm water regulatory programs about the problems and solutions to plastic debris discharges from industrial operations.
47. Develop an Operation Clean Sweep certification program (similar to green business programs).
48. Educate the plastics industry about storm water compliance and BMPs.
49. Update Operation Clean Sweep to include additional BMPs and information.

Actions to Reduce Product Waste

INCREASING WASTE REDUCTION

50. Encourage consumers to reduce their use of single-use disposable goods and packaging through education, consumer fees, and incentives.
51. Increase plastic bag recycling.
52. Increase recycling of plastic non-beverage containers and packaging waste in California.
53. Investigate the feasibility of creating a CRV refund for non-beverage containers.
54. Develop a labeling system that clarifies which plastics are recyclable.
55. Provide business incentives for source reduction.
56. Reduce commercial business waste by implementing in-store waste reduction measures and educating customers in ways to reduce waste.
57. Model source reduction in schools.
58. Impose limits, bans, and prohibitions on materials that more commonly become litter and marine debris.

Reducing Waste Generation in California

59. Investigate reducing the volume of products solid waste generated if California were to adopt an Extended Producer Responsibility Program.
60. Investigate reducing the volume of product waste through a system of shared responsibility for waste.

CHANGES IN PRODUCT PACKAGING AND DESIGN

61. Redesign packaging to reduce waste and impacts on the marine environment.
62. Develop an environmentally-preferred packaging standard for California and a program for its implementation.
63. Conduct a compostable and degradable litter study.

Glossary of Acronyms

AMRF	Algalita Marine Research Foundation
APC	American Plastics Council
BMP	Best Management Practice
CalEPA	California Environmental Protection Agency
CASQA	California Association of Storm Water Quality Agencies
CCC	California Coastal Commission
CIWMB	California Integrated Waste Management Board
CRV	California Redemption Value
CSP	California Department of State Parks
DBW	California Department of Boating and Waterways
CALTRANS	California Department of Transportation
DOC	California Department of Conservation
EPR	Extended Producer Responsibility
ICC	International Coastal Cleanup
KCB	Keep California Beautiful
MSW	Municipal Solid Waste
NASBLA	National Association of Boating Law Administrators
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
OCS	Operation Clean Sweep
RCRA	The Resource Conservation and Recovery Act
RPPC	Rigid Plastic Packaging Container
RWCB	Regional Water Quality Control Board
SPI	The Society of the Plastics Industry
TMDL	Total Maximum Daily Load
TOC	The Ocean Conservancy
SCCWRP	Southern California Coastal Water Research Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
U.S. EPA	United States Environmental Protection Agency

PRINTED ON MINIMUM 15% RECYCLED POST-CONSUMER PAPER